Psychology and Scientific Research. III. The Transactional View in Psychological Research

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WHEN PSYCHOLOGY EMANCIPATES ITSELF from dependence on interactionism alone by taking a transactional view of the phenomena which come within its province, we should expect that the division of psychologists into schools would rapidly disappear. Schools (Gestalt, behaviorism, psychoanalysis, etc.) would disappear not because they are "wrong" or "have been overthrown" but because the formulations of each school that meet empirical tests would be encompassed within wider formulations of problems. What are some ways to speed this development?

First of all, the psychologist must not only realize intellectually, but must make a part of his functional assumptive world, the idea that man's thought and behavior can be understood only as processes of a "full situation of organism-environment." The point has been made by H. A. Murray and collaborators in their contention that "the main body of psychology started its career by putting the wrong foot forward and it has been out of step with the march of science much of the time. Instead of beginning with studies of the whole person adjusting to a natural environment, it began with studies of a segment of a person responding to a physical stimulus in an unnatural laboratory environment" (*10,* 466). Brunswik, in his "ecological analysis," has pointed out the need to understand the complete "representativeness of circumstances" operative in any situation under observation (*2*). But while an increasing number of psychologists are calling for a revision in traditional psychological procedure, their voices are still those of men crying in the wilderness of the universe which constitutes so much of psychological inquiry today. The psychological investigator, of all people, cannot separate the observer from what is being observed, the process of knowing from what is known, what is "out there" from whatever goes on in the experiencing organism. Psychology must disavow completely any "field theory" which implies that an environmental field acts *on* a person rather than *through* a person.

Because man inevitably builds up for himself an assumptive world in carrying out his purposive activities, the world he is related to, the world he sees, the world he is operating on, and the world that is operating on him is the result of a transactional process in which man himself plays an active role. Man carries out his activities in the midst of concrete events which themselves delimit the significances he must deal with.

In the process man is himself changed in greater or lesser degree by having his own assumptive world changed through confirmation or denial as a result of action. In his immediate activity man abstracts from the immediate situation certain determined aspects according to his assumptive world. And this, as we indicated, includes far more than the immediate occasion: it is a continuum which includes the past and the future, a storehouse of both past experience and ideals. As Bentley has pointed out, "Behaviors are present events converging pasts into futures. They cannot be reduced to successions of instants nor to successions of locations. They themselves span extension and duration. The pasts and the futures are rather phases of behavior than its control" (*1,* 485). Psychologists must be constantly aware of the effects man's own actions have both on his assumptive world —confirming or denying certain aspects of it—and concurrently on the "environment out there" as it is perceived and experienced.

Another implication of the transactional mode of observation is that the psychologist, like any other scientific investigator, must be sensitive to the pitfalls involved in reifying anything as an entity that has been given a proper name—a pitfall that philosophers since Plato have inveighed against. Psychologists, like other scientists, must become increasingly self-conscious of the dangers to their scientific progress inherent in catchwords, whose use, as Dewey and Bentley point out, "shatters the subject matter into fragments in advance of inquiry and thus destroys instead of furthering comprehensive observation for it" (*6,* 243). Any uncritical use of traditional abstractions makes it difficult or impossible to see together what has already been taken apart.

While academic psychologists have long since given up the entity of the *soul,* and while most of them, at least in their professional writing, refuse to talk of the

mind,[1] many other entities have slipped into the professional jargon of psychology to make transactional observation difficult. We have, for example, *need, I. Q., schizophrenic, trait, attitude, Oedipus complex,* and *mesomorph.* The uncritical use of such words as specifications can easily lead to redundancy and double talk.

Psychology runs the risk of retarding its discovery of new bases for psychological standards through the use of bases for standards employed successfully in the past by the physical sciences. For example, psychologists refer to "the size of the retinal image," "visual angles," "intensity of opinion," "field forces," "gradients," "positive or negative valences," "vectors," "depth psychology," and some even search for the physical dimensions of consciousness, limiting physical dimensions to a handful of constructs. Psychology has by no means emancipated itself yet from the standards of the physical sciences and is not rapidly enough discovering standards appropriate for the phenomena with which it deals.[2] By refusing to place firm reliance on standards whose bases are necessarily subjective, psychology sometimes complacently throws out some of the most important problems with which it should be concerned. Nouns such as *surety, anxiety, ego-involvement, expectancy, happiness,* imply adjectival or adverbial relationships that are purely subjective. There are plenty of bases available for standards if the psychologist dares use them as he becomes sensitive to the importance of the problem of selecting bases for standards appropriate for the inquiry at hand.

It has become increasingly clear in recent years in the fields of chemistry and biology, for example, that standards appropriate to the subject matter of investigation must be sought and that reliance on the standards of classical or modern physics alone will hamper investigation. For example, J. G. Hoffman, a professor of biophysics, has recently noted that "the word biophysics . . . is a ridiculous combination of incongruous extremes. Disciplined scientific thought has never taken more diverse forms than it has in the fundamental modes of thinking in biology and in physics" (*8*, 7). In pointing out the limitations of a physical mode of observation for the study of living systems, Hoffman quotes Delbrück's statement that "instead of aiming at the whole of the phenomena exhibited by the living cell we now expect to find natural limits and, thereby, implicitly, new virgin territories, on which laws may hold which are independent of those of physics, by virtue of the fact that they relate to phenomena whose appearance is conditioned on *not* making observations of the type needed for applying atomic physics" (*8*, 14).

There is also a tendency in psychology to use catchwords in labeling the fields of social, clinical, educational, or industrial as "applied" fields of psychology and to separate them from the more traditional "experimental" psychology. Any such division is absurd unless the person who uses it consciously reserves it for rough descriptive purposes. Investigators in these fields must, of course, also rely on experiments. But beyond that, any such distinction acts as a deterrent in the search for more adequate formulations which will better account for human behavior, whether in the laboratory, the clinic, the factory or in everyday social life. It is especially in fields such as these that one encounters hitches in interpretation because of the huge number of variables involved in the concrete situations that constitute each of the areas of inquiry. When such hitches are encountered, the investigator does not merely "apply" to their resolution some theory he has read in a book or learned from laboratory experiments. To be sure, he brings such knowledge and experience into the process of hypothesis formation. But the chances are very high indeed that any theory which is not itself based in large part upon the understanding of similar full-bodied concrete situations will turn out to be extremely inadequate.

We can illustrate the way in which psychological inquiry has been restricted by the use of terms with reference to the field of perception, which has so often been a weathervane in psychology. In working on perception, psychologists early found that certain variations in objective or physiological factors produced marked subjective variations. This naturally led to the idea of correspondence between subjective factors on the one hand and objective and physiological factors on the other hand. Since an alteration of objective and physiological factors could so easily be shown to cause subjective effects and since the converse could not so easily be demonstrated, the assumption was built up that the subjective aspects of perception had their origin largely in the corresponding objective factors and the accompanying physiological disturbances they caused. Studies of perception have thus concentrated largely on the analysis of ob-

[1] A good example of a scientist who used the transactional method of observation was G. E. Coghill, who taught himself to see every organism in terms of a manifold of three inseparable constituents—structure, function, and mentation. The word *mentation* Coghill used as a substitute for *mind*, to connote the constant organism-environment transaction (7, 198).

[2] It is significant that psychological terms describing capacities of human beings are occasionally used by natural scientists as rough specifications of certain phenomena they encounter. For example, mathematical physicists, in describing the behavior of some of their electronic computing machines when they become overloaded, call them "neurotic"; while biologists occasionally speak of the phenomenal "memory" which the cells of the body exhibit for certain stimuli.

jective and physiological factors. And since these objective or physiological factors could be varied quantitatively, scientific methodology in psychology tended to become identified with measurement alone.

This led to a long neglect of those factors not amenable to precise measurement. These neglected factors were, of course, subjective factors described by such symbols as past experience, loyalties, expectancy, and purpose, whether these were operating consciously or unconsciously. This methodological dam has recently been cracked, largely through research in social and clinical psychology, where the effects of subjective factors on perception are especially obvious. More recently, in an attempt to liberate investigators somewhat from correspondence between subjective and objective or physiological factors, the Hanover Institute has designed demonstrations of perceptual phenomena which deliberately make use of illusions. By using illusions, the investigator gains more freedom to understand the nature of the functional activities that are involved in the scientific inquiry of perception and thereby gets a better toehold on the function of perception in man's purposive behavior. For example, it can be demonstrated that the perception of *where* a thing is depends upon the perception of *what* a thing is and on *when* it is perceived. Carr has pointed out that "illusions contrasted with correct perceptions are the experimental variants that reveal the common principle involved in both" (*4*, 326).

On the basis of an interactional view alone, an investigator could study the interdependence of various aspects of a perception forever and never get at the reason for such relationships until he asked himself what function such an interrelationship of phenomena served in the transaction of living. When he asks himself this question it appears that variables such as size and distance are experientially related because it is only through their relationship in past experiences that high prognostic reliability is built up. Prognostic reliability becomes itself, then, a new dimension of experience, a new basis for a standard the psychologist can use for experimentation. And if the investigator continues, as he must, to ask the next question concerning the function of prognostic reliability in a life transaction, the apparent answer is that prognostic reliability of a perception increases effective action. So the effectiveness of action becomes another variable that can be used as a basis for a standard in experimentation. And there must follow, of course, the question: Effective action for what? We then see that we cannot understand even the simplest perception without bringing in the variable of purpose.

The transactional mode of observation seems, then, to be peculiarly appropriate for psychologists if they are going to seek what Collingwood has called more abstract, more universal "logical grounds" for the understanding of subordinate abstractions or phenomena (*5*). Obviously, if we do not understand the logical ground that causes relevant variables to be relevant, then our scientific methods will be sterile indeed. Hence progress in psychology is to be measured largely in terms of the discovery of logical grounds which increase our understanding because of their intrinsic reasonableness and the possiblity they hold out of verification by experimental methods. Many of the abstractions Freud created are a case in point.

The transactional view has a third implication for psychology which concerns the method of experimentation that must be involved in real research. Different subjects for scientific inquiry pose different kinds of problems that can only be solved by adapting or creating methods appropriate to them. In saying that any one scientific discipline has special circumstances of its own which determine the techniques to be used, we are not in any way denying the indispensability of the universal characteristic of scientific method: the controlled experiment. All we are saying is that we must increase our self-consciousness and our ingenuity concerning the use and meaning of *controlled* and not claim that we are undertaking controlled scientific investigation when our assumptive world artificially limits the number of potential controls we are aware of.

One difficulty in the use of experimental techniques in psychology and the social sciences is that of approximating in a controlled experiment any concrete situation in which thought and behavior normally occur. Although this has been pointed out many times, and although the difficulty is easily recognizable, psychologists must be particularly on their guard to see that, in the experimental situations they devise, they have not left out so many of the subjective variables involved in normal experience that their experimental results will have little subsumptive power.

A second and much less frequently realized difficulty is that in dealing with the human organism we are dealing with a particular variety of "world stuff" which perceives complicated significances. Unless we make a special effort to understand the particular significance a particular organism at a particular time and place attaches to all the stimuli involved in our investigations, we shall again have abstracted out of the situation perhaps the most important variables for study. In psychology it is imperative that the investigator be as aware as possible of the unconscious assumptions brought by his subject to any experimental situation. Otherwise he will not have the slightest idea of what aspects of the

phenomenon under investigation are most important. This awareness of assumptions is as important for the psychologist to have in mind in understanding the perception of a chair as it is in understanding social perceptions.

Still another difficulty facing the psychologist is the comparative lack of any agreed-upon bases for standards by means of which experimental situations can be described and repeated and results can be interpreted. The search for appropriate bases for standards is obviously one which requires great caution and wisdom in an area such as psychology because of the number of unknown variables apt to be involved in any standards set. Much careful research is still needed to discover what variables should be used as the bases for standards to provide the most useful analysis of man's experience.

Value Judgments and "Objectivity"

A great deal of discussion has taken place in recent years concerning the possibility or the desirability of complete "objectivity" in science. The publication of Karl Pearson's *Grammar of science* in 1892, (*11*) with its contention that an understanding of scientific method can train "the mind to an exact and impartial analysis of facts" and can free the individual from bias in the formation of judgments gave a great boost to the myth that real scientific inquiry somehow goes on in a world devoid of personal judgments. The contrasting point of view has been expressed by Whitehead (*12,* 228 f.):

> Judgments of worth are no part of the texture of physical science, but they are part of the motive of its production. Mankind have raised the edifice of science, because they have judged it worth while. In other words, the motives involve innumerable judgments of value. Again, there has been conscious selection of the parts of the scientific fields to be cultivated, and this conscious selection involves judgments of value. These values may be aesthetic, or moral, or utilitarian, namely, judgments as to the beauty of the structure, or as to the duty of exploring the truth, or as to utility in the satisfaction of physical wants. But whatever the motive, without judgments of value there would have been no science.

It is becoming increasingly clear that the process of mentation involved in scientific inquiry is not a simple one of bringing "impartial analysis" to bear on a set of conditions. The scientist's own value judgments are involved in (1) sensing the inadequacy of his conceptual structure—posing a problem for himself; (2) sensing the functional activities or subphenomena which may be involved in the phenomenon that has caused the original hitch; (3) deciding on which aspects of a phenomenon (variables) can fruitfully be used as bases for standards in experimentation; and (4) designing an experimental procedure to test the validity of these bases for standards. Scientific research thus involves an elaborate process of weighing and integrating which may take place largely on an unconscious level.

In this process, all of the unconscious assumptions, all of the awarenesses, and all of the conceptual abstractions of the individual investigator's assumptive world are operative. Whether any scientist likes to admit it or not, any interpretation he makes must be regarded as a value judgment. To be sure, rational thought and the conscious intellectual manipulation of abstracted variables can, often do, and obviously should, play a most important role in the process of scientific inquiry. But to assume that rational thought and conscious manipulation alone are the determinants of the judgments involved in scientific research is to go against the overwhelming evidence already obtained from scientific research itself. The dictionary definition of the word *objective,* in the sense it is used in discussions concerning the objectivity of science, is: "Emphasizing or expressing the nature of reality as it is apart from self-consciousness; treating events or phenomena as external rather than as affected by one's reflections or feelings." For example, our knowledge of perception, showing that "the nature of reality" as we experience it would not exist *except for* the assumptive world we bring to a concrete situation, flatly contradicts the contention that the scientist can be objective in any such sense.

The objectivity of science can therefore only refer to the use of accepted rules of empirical research *after* the problem, the variables, and the experimental design have been decided upon. Here the scientific investigator takes every precaution he can to see that he does not misinterpret what he observes by allowing any subjective bias to enter into the actual conduct of the experiment itself.

Not only is objectivity illusory in the sense of eliminating personal bias: it is also undesirable. We cannot improve on the conclusion reached by Herrick (*7,* 180 f.) after a lifetime of productive research in neurology:

> The bias which arises from unrecognized personal attitudes, interests, and preconceptions is the most treacherous of all the subversive enemies of sound scientific progress; yet these attitudes and interests are the key factors in all really original scientific investigation. This issue must be faced frankly and courageously. The easy way out is to ignore the troublesome personal ingredients of the problem and say that science has no concern with them. This is now generally regarded as the standard or normal scientific method. But actually this cannot be done, and we cannot afford to try to do it; for the interests and the attitudes of the inquirer shape the whole course of the investigation, without which it is meaningless and fruitless. To neglect these components of sci-

entific work and the satisfactions of a successful outcome is to sterilize not only the process but also the results of the inquiry. The vital germ of untrammeled imaginative thinking is thrown into the discard, and too often we seem quite content with the dead husk which is so easily weighed, measured, classified, and then stowed away in the warehouse.

In the social sciences, Robert Lynd has made the same point in his plea for "outrageous hypotheses" (*9*).

The myth that "science is objective" may tend to be fostered in most cultures today in an attempt to preserve whatever status quo exists by giving it scientific blessing. But any scientist will resent boundaries placed on his thinking by social, economic, political, religious, or any other ideological barriers and taboos. This danger is especially prevalent in the field of inquiry labeled "social psychology" and in the social sciences, where the data gathered have been largely determined and preconditioned by the purposes and conditions within which the investigator has worked.

Psychologists and social scientists who honestly try to bring their most mature value judgments to bear on concrete social problems are all too frequently labeled as biased, crackpot reformers if they even implicitly criticize existing social relationships. Yet it is because scientific inquiry is shot through with value judgments that no scientist can avoid some responsibility for the judgments he makes. And because value judgments play so important a role in scientific thinking, ways and means must be discovered of making value judgments themselves the subject matter for scientific inquiry (*3*). Value judgments concern the significance of the constant emergents which are not subject to explanation in determined and verifiable terms. Here the scientist has a freedom of choice; here conscience, the "sense of oughtness," must be recognized as the highest standard for effective action. When the subject matter with which the scientist deals consists of human beings trying to act effectively to carry out their purposes, then the social responsibility of anyone who pretends to be an expert obviously becomes very great indeed.

Accelerating Research in Psychology

Our recurring theme has been that any truly scientific investigation involves much more than the use of an accepted methodology of experimentation. We have tried to show why the progress men hope for in their understanding of themselves can come about only to the extent that those who are professionally concerned with such an understanding become increasingly sensitive to the problem of problemization.

But readers already sympathetic with our emphasis may be reminded of the dramatic critic who, after pointing out the second-rate quality of then current productions, ended his comments with the statement that what we need are better plays. Are there any concrete suggestions which might speed up the search for more and more adequate formulations psychologists would seek to verify experimentally? A few have occurred to us.

We have pointed out that scientific inquiry, like any inquiry, begins when we meet a hitch, when we sense the limitations of or doubt the adequacy and reliability of our assumptive worlds as we try to act effectively. From this it follows that every attempt must be made to increase an investigator's consciousness of the range of hitches that must be faced and that are inherent in attempts to resolve problems. We must get across the notion that hitches are not obstacles to be avoided but, on the other hand, challenges which alone make productive research possible. No one can be "trained" to do research merely by having a set of rules spelled out for him. A good investigator, like a good clinician, a good advertising man, or a good labor leader, will be produced only when there is a real desire and ability to use ingenuity in meeting the hitches that occur in carrying out purposive action.

It has long been apparent that no one person today can be thoroughly competent, knowledgeable, and experienced in the diversified areas of inquiry that impinge on and are necessary for a proper understanding of man. More than mere cross-fertilization or broadened specialization is needed. Can ways and means be found to make it possible to bring together investigators who agree on the probable common significance of the hitches they face and on the probable order of importance of the hitches that must be resolved for improved understanding? Perhaps informal organizations are required which will make it possible for men of diverse experience to work and commune together as the occasion demands, on common problems and on the same level without reliance on one another's authority and unrestricted by limitations of time or any goal other than the search for more adequate concepts. Psychologists and social scientists will have to work out organizational and communicating techniques so their search for the more adequate conceptualizations people expect of them will not be hampered by formalities or administrative duties.

All investigators are caught in and influenced by a traditional mode of thinking and teaching cluttered up with catchwords, with an emphasis on the interaction of variables, with an overconcentration on methodology for its own sake. In academic circles the tendency all too often is to feel that the student—and the professor—have essentially "covered" the prob-

lem of formulation if various systems and theories of psychology have been reviewed. The psychologist's relative lack of concern with the problem of more adequately formulating emerging problems is often reflected in what seems to be his extreme self-consciousness in respect to the short history of his discipline.

We are not in the least denying, of course, that rigorous methodological standards must be insisted upon or that the history of the subject should be reviewed. But we do feel that progress in psychology can be brought about more rapidly only if methodological procedures are considered in relation to concrete problems and if the history of psychological investigations can be viewed from the perspective of problems that now seem significant, rather than vice versa. Whitehead has nicely stated both points in his dicta that "the main evidence a methodology is worn out comes when progress within it no longer deals with main issues" (*13,* 13) and that "a science which hesitates to forget its own history is lost" (*12,* 162).

(*This is the third of a series of three articles.*)

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The 112th Annual Meeting of the British Association for the Advancement of Science

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THE 112TH ANNUAL MEETING of the British Association for the Advancement of Science was held in the heavily industrialized northern England town of Newcastle-upon-Tyne, in the first week in September. Some 3,500 persons—scientists and science-minded citizens—were present.

This area has a great technological tradition, for—as Pierre Auger, head of Unesco's Natural Sciences Department, pointed out in an official address—"It was in this ancient city of Newcastle that the world-famous engineer George Stephenson, a century and a quarter ago, established the iron works where were built the first steam engines that went puffing into history between Stockton and Darlington, and Manchester and Liverpool—and began a new and splendid phase in industrial development."

The theme for this meeting was set by Sir John Russell, who devoted his presidential address to a review of the world's food and population problems. He pointed out that the present population of the world—2,300,000,000—was increasing by 20 millions a year. That meant an average addition of two every three seconds, day and night, year after year, and these two might become more as science advanced, social services improved, and international organizations became fully operative.

About 11 billion acres of the world are climatically suited to crop growth, he said: but of this area, only 3 to 4 billion acres are used—7 to 10 percent of the world's land surface—for both food and industrial crops. There is no need, however, for gloom. Science is continuously opening up new possibilities. For example, thyroxin, or iodated protein, fed to cows by mouth, can increase the fat content of milk and augment the yield by another 20 percent. Even more dramatic is the use of a synthetic estrogen (the female sex hormone) introduced under the skin, for inducing lactation in virgin heifers or barren cows. This is the first stage in making the male redundant.

Experiments with rabbits, Sir John pointed out, have shown that at some time in the near future a single pedigreed cow might produce 75,000 calves without undergoing the pangs of birth. The calves would come from "living incubators"—inferior cows in which an ovum had been transplanted from the pedigreed animal and then fertilized by artificial insemination. In this process, again, a bull might become all but obsolete.

Among other research results which have an immediate practical application, Sir John Russell mentioned:

The use of auxins. A spray of β-naphthoxyacetic acid, 40 parts per million of water, has been used by commercial growers of tomatoes and cucumbers to produce fruits normal in appearance but not yet in quality. They are seedless.

The work of R. Brown, of Leeds, and A. R. Todd, of Cambridge, on chemical stimulants and pests. They have found that the seeds of witchweed (*Striga*), a flowering plant that parasitizes sorghums and millets and is the cause of much loss in Africa and India, germinates only when stimulated by substances excreted from their roots. This substance is apparently a sugar. If the different varieties of sorghum should differ in their ability to prepare and excrete this stimulant, a chemical test might be devised that would greatly assist plant breeders searching for resistant strains. It is possible that other parasitic fungi could live only on varieties of plants capable of producing the necessary stimulant.

The fact that various soil organisms are known to produce antibiotic substances analogous to penicillin. For example, Thaysen and others have found in tropical soils bacteria with high powers of inhibiting the growth of fungi. In the absence of a good soil fungicide it is possible that soil-borne fungal diseases may be successfully controlled by introducing or encouraging organisms producing the appropriate antibiotic.

The subject of "Food and People" was discussed at a public meeting held under the chairmanship of Sir John Russell. Pierre Auger contrasted the eagerness with which Great Britain accepted the railway as a means of increasing the wealth and resources of mankind with the current doubt as to whether science should be regarded as a friend or the enemy of mankind. If man wishes, he can use science and technology to rid himself of illness and disease, and to remove the burden of unproductive and uneconomic toil. He gave details of the major experiment in mass enlightenment begun by Unesco, in an attempt to organize in many countries active discussion of this topic, with the object of focusing the attentions of the peoples of the world on this urgent problem. Unesco hopes to show not only the necessity for international cooperation in solving the problem, but also that such collaboration is already taking place at all levels among the existing international organizations.

Lord Horder said that he believed man could achieve such physical, chemical, and biological control of the earth as to enable him not only to adjust population to food, but also food to population. He warned, however, that food would not be produced, even with the full utilization of science, without hard work. The ultimate consideration, he said, is moral control, of which the simplest expression is live and let live. He wondered whether it came within the province of science to obtain that indispensable moral control.

Other speakers described developments in the British Commonwealth in the attempt to supply the world with more food.

Sir David Rivett said that Australia would need more first-class scientists. Geneticists are needed to develop from British cattle breeds that are already established in Australia, strains adapted to local conditions. The fertility of rams is affected by high temperatures, and knowledge of climatic influences on the fertility of rams and ewes is needed to raise the present low lambing percentage. Speaking of the possibility of more efficient use of present resources, he told of how, in Australia, skimmed milk is used mainly as pig food. But research has revealed that in that waste there are more first-class animal proteins than in the whole of the beef and mutton production of the Commonwealth.

A. C. Hardy rather startled many scientists when, in his section presidential address "Zoology Outside The Laboratory," he expressed a belief in telepathy. He said:

> It is perhaps unorthodox for a zoologist to introduce such a topic, but I do so for a reason. If telepathy has been established, as I believe it has, then such a revolutionary discovery should make us keep our minds open to the possibility that there may be so much more in living things and their evolution than our science has hitherto led us to expect.
>
> Such an idea as I am about to suggest is no doubt highly improbable and would perhaps be better kept locked in a bottom drawer; I mention it, however, merely as a reminder that perhaps our ideas of evolution may be altered if something akin to telepathy—unconscious, no doubt—was found to be a factor molding the pattern of behavior among members of a species. If there was such a nonconscious group behavior plan, distributed between, and linking, the individuals of the race, we might find ourselves coming back to something like those ideas of subconscious racial memory of Samuel Butler, but on a group rather than on an individual basis.
>
> It would remove many of the fatal difficulties of his hypothesis. Samuel Butler's ideas were, of course, the logical development of Lamarck's, but thought of independently.

If there was such a group habit and behavior pattern it might operate through organic selection to modify the course of evolution; working through selection acting on the gene-complex. If this flight of fancy ever proved to be a fact, it would be a wedding of the ideas of Darwin and Mendel on the one hand, and Samuel Butler and Lamarck on the other.

Professor Hardy made a plea for more ecological research. He defined ecology as "the conversion of natural history into science," which involved more than the expressing of the interrelationship of organisms with their environment, living and inanimate, in numerical terms. The aim of ecology is to discover more of the laws operating in the world of living things. He remarked on the fact that ecological knowledge of marine life is much more advanced than that of man's ordinary terrestrial surroundings.

Sir Alexander Gray, in his presidential address "Economics: Yesterday and Tomorrow," said that the problem of government is essentially one of expediency; above all, it is concerned with the urgent question of how to keep going for the next six months. The enunciation of a flawless theory of wages, if such could be formulated, would never still the passions which had given rise to a strike. Accordingly, he believes the economic adviser should at times be able to forget that he is an economist, and indeed to realize that there might be occasions when he ought to forget his economics. He is certain that a structure of economic theory that is not based on sound psychology is a house without foundation, therefore the economist must be a psychologist, of a sort.

There is no room here to do more than mention some of the other interesting papers that were read.

Kenneth Oakley, of the Natural History Museum in London, read a paper to the anthropological section on his fluorine test. Fluorine is a gas which, in the form of fluorides, occurs as a trace in most ground water. When fluorine ions reach bone material, they are locked into the ultramicroscopic mesh of the calcium phosphate crystals. Once they thus enter they are not released, and the fluorine content of the bone increases with time. This fact provides rather a neat means of distinguishing fossilized bones of different ages occurring at a particular place, though it does not make it possible to date an individual bone in isolation.

In the physics section, some papers were read on recent techniques applied to astronomical problems.

J. S. Hey, of the Army Operational Research Group, dealt with investigations of solar radio noise. This is emitted in two forms. First there are fairly sharply beamed emissions from sunspots, a maximum being obtained when the sunspot is near the central meridian on the sun's disk. Next there are very sudden bursts of emission from solar flares, which are tongues of very hot gas moving at immense speed from the solar surface near the sunspots. This type of emission is characterized by its suddenness, and it does not appear to be beamed. There seems to be a greater chance of radio emission with flares occurring on the east side of the sun's disk than with flares in any other position. Intense ionization of the lower part of the ionosphere is simultaneous with the flare and the radio emission. It seems that this intense ionization is caused by ultraviolet light from the flare, and the result is a complete black-out of long distance radio communication on the earth.

F. G. Smith, of Cambridge, described work on radio techniques applied to the analysis of radio noise coming from the rest of the galaxy. The first problem is to determine whether the noise comes from a diffuse interstellar gas or from point sources such as the known stars. From experimental evidence at Cambridge it appears that there are two major sources and 23 smaller ones, and with certain assumptions the diameter of the source seemed to be less than ten light seconds, i.e., of the order of size of an average visual star. It appears that the noise is due to electrons having a random motion of at least 10^{10} electron volts. The great energy suggests that the origin of cosmic rays is the same as that of the radio noise investigated.

A. C. B. Lovell, of Manchester, described new developments in meteor astronomy. He said electron trails formed by the burning away of a meteor make excellent radar targets and can thus be detected on a cathode-ray screen. Difficulties occur because of the immense speed of the meteors, in the neighborhood of 100,000 miles an hour, thus producing radar echoes of extremely minute duration. As the central problem of meteor astronomy is to discover where the meteors come from, it is very important to determine the meteor speed very accurately, for a difference of less than 1 percent in the velocity means the difference between a meteor belonging to the solar system, i.e., moving in an orbit around the sun, and one from interstellar space.

W. C. Hodgson and K. M. Rae described two types of apparatus for submarine investigation. The continuously recording echo-sounder gives the depths at which fish are swimming and allows the nets to be adjusted accordingly. It also allows the extent of a shoal to be calculated and therefore the likely catch. Herrings, sprats, cod, and mackerel can all be identified by the characteristic trace they give on the paper record. The other apparatus is a recorder which, towed behind a ship, gives a continuous record of plankton (the small animal life on which fish feed). Much time, money, and effort could be saved by this technique when fishing research comes to be conducted

such large areas as the Pacific. It would give a road basis on which to plan more detailed research cruises.

The impact of science on society was implicit in all papers read, and Sir John Russell, in his presidential address, raised some controversial points about the powers of science. He said:

> It can do much to overcome material difficulties and, better still, to satisfy man's thirst for knowledge of the universe in which he lives, and it can insist continuously on our high duty to seek out the truth fearlessly and honestly, and having found what we believe to be the truth, to proclaim it—but in all humility and recognizing that we may be wrong. Apart from that, science can give little guidance in those great moral and spiritual problems which lie at the root of our most serious troubles today. It opens up many possible ways of life but gives no help in choosing which to follow, it deals with the facts of existence but not with the values of existence. It offers us great possessions but, as the old aristocracy knew, great possessions imply great personal responsibilities. Democracies still have this to learn. That is one of our greatest problems today.
>
> Science can help us best if we have a sustaining faith, a high purpose in life and unflinching courage to pursue it.

Sir Alfred Egerton summed up the general feeling when he said:

> Looking back to the turn of the century and remembering the stage of chemical science at that time, then seeing in my mind's eye the integrated achievements of chemists since those days, I cannot but believe in a bright future: "That which they have done is but an earnest of the things they shall do."

Next year's meeting is to be held in Birmingham, and the new president of the British Association for the Advancement of Science is Sir Harold Hartley. The 1951 meeting is to be held in Edinburgh, under the patronage of the Duke of Edinburgh.

TECHNICAL PAPERS

A Reversible Photochemical Alteration of Uracil and Uridine[1]

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Various lines of evidence (*1, 3, 4*) have suggested that the primary effect of lethal and mutagenic doses of ultraviolet radiations upon living cells may be partially reversible, or at least compensated within the cell. In connection with a general study of the photochemistry of nucleic acid derivatives, we have discovered that, under certain conditions, the initial photodecomposition product of the pyrimidine, uracil, and the corresponding product of the ribose nucleotide, uridine, may spontaneously revert to the initial substances, uracil and uridine, respectively.

A distinction must be made between the effects of radiation in the longer wave pyrimidine absorption region, 2300–2800 A, and the effects of short wave radiations of wavelength less than 2300 A. The former radiation gives rise to the partially reversible effect, whereas the latter produces—with a much higher quantum efficiency—an irreversible decomposition.

In our experiments we have employed as a radiation source a low pressure mercury discharge tube, wound in the form of a spiral, obtained from the Hanovia Chemical and Manufacturing Company. The principal radiation from this tube is the 2537-A mercury line, but photochemically significant quantities of 1849-A, 1942-A, and 2224-A radiation are emitted. We have filtered these latter out with a 1-cm path of absolute ethyl alcohol.

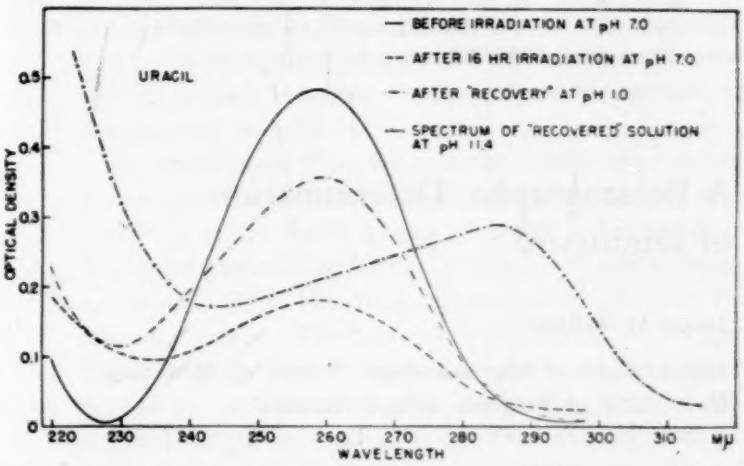

FIG. 1.

The solutions have been irradiated directly in the silica cells of the Beckman DU Spectrophotometer. Under these conditions, it is possible to destroy 63% of the absorption of a uracil solution (6.2 μg/ml in M/100 PO_4 buffer, pH 7.0) at the uracil maximum, 2590 A, in 16 hr of irradiation (Fig. 1). If now the pH of the irradiated uracil solution is changed to 1.0 (by addition of 1 ml 1 M HCl to 3 ml of irradiated solution), the absorption at 2590 A is then found to rise exponentially, following first-order kinetics, with a rate constant of 14 min at room temperature. As shown in Fig. 1, 74% of the

[1] This study was supported by the American Cancer Society, acting through the Committee on Growth of the National Research Council.

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initial absorption can be recovered. That the substance responsible for the recovered absorption is uracil is indicated by the absorption spectrum and by the characteristic shift in absorption (*2*) upon making the solution of the recovered material alkaline to pH 11.4.

Some increase in absorption takes place if the irradiated solution is allowed to stand at pH 7.0, but the rate of increase is extremely slow at room temperature. This rate may be accelerated by increase of temperature; immersion of the irradiated solution into boiling water for 15 min can bring an increase in absorption comparable to that produced by addition of acid. Recovery in acid solution, however, has given more reproducible results.

Irradiation of uridine has led to qualitatively similar results. Uridine appears to be some 16 times as labile to ultraviolet irradiation as uracil, when compared at pH 7.

Under these conditions of irradiation, thymine, cytosine, adenine, and guanine, and adenylic and guanylic acid are not decomposed. However, preliminary experiments have given evidence of a similar reversible phenomenon with cytidylic acid.

More complete details of this work will be published elsewhere.

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A Polarographic Determination of Digitoxin[1]

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In conjunction with a polarographic investigation of a variety of organic compounds of pharmaceutical interest, a study of the polarographic properties of digitoxin was instituted. Fieser (*1*) reported that the cardiac glycosides gave polarographic half-wave potentials in the region between −1.9 and −2.0 volts. The present investigation confirms Fieser's work and elaborates on the qualitative and quantitative polarographic properties of digitoxin. The results of this study show that digitoxin may be determined in concentrations as low as 0.1 μg in 50% alcohol solution and may also be extracted by means of suitable solvents from complex mixtures and determined in similar low concentrations.

The method used to carry out these investigations was as follows: A stock solution of the pure drug[3] was prepared by dissolving 25 mg of digitoxin in 12.5 ml of absolute alcohol and diluting to 25 ml with distilled water. Varying amounts of the stock solution were

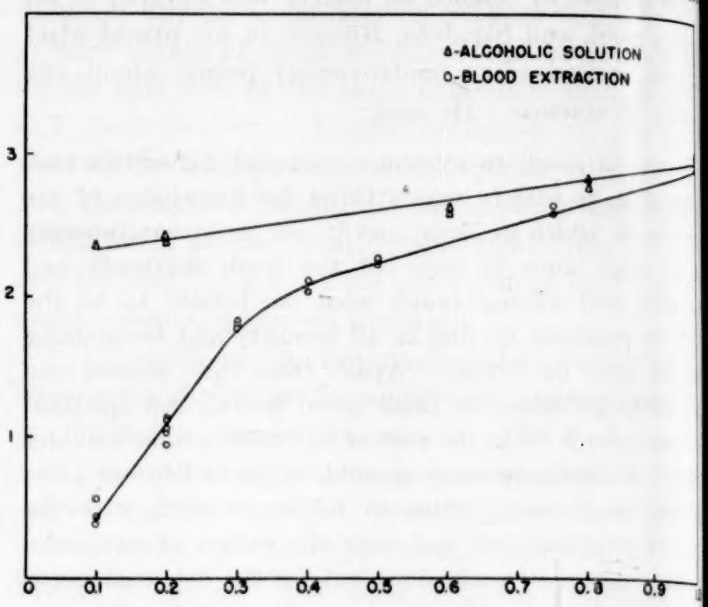

FIG. 1. Height versus concentration curves for digitoxin between 0.1 and 1.0 μg. Upper curve (△), alcoholic solution; lower curve (○), extraction from blood. Abscissa, concentration of digitoxin in μg; ordinates, height in in. (1 in. = 0.508 μa).

added to 0.5 ml of 0.2 *N* tetraethyl ammonium hydroxide in a Heyrovsky reaction vessel and diluted to 5 ml total volume with 50% alcohol solution in order to study the half-wave potential and height of break at different concentrations. For extremely low concentrations, a stock solution of lower concentration was prepared and diluted in a similar manner. Nitrogen was bubbled through the prepared solutions for a period of 15–20 min and the polarogram recorded. This process was repeated until a satisfactory curve of height versus concentration had been determined for the concentrations under investigation and the average half-wave potential was calculated.

The study of digitoxin in blood was carried out by a combination of extraction and polarographic work. The most satisfactory extraction solvent was found to be petroleum ether. The procedure followed for the investigation in this portion of the experiments was as follows: Varying amounts of stock solution were added to 10 ml of mixed blood, and 2.5 times the total volume of petroleum ether used for extraction. The combined mixture and extraction solvent solution was placed in a separatory funnel and shaken. After thorough settling the residual blood was drawn off. The remaining solution was shaken and allowed to settle until no blood residue appeared after shaking. The petroleum ether fraction was placed in an evaporating dish and evaporated to dryness. This residue was dissolved in 2.5 ml of absolute alcohol and decanted so that no alcohol-insoluble components would be in the final solution. The alcohol solution of the residue was diluted to 5 ml with distilled water and 2.5 ml of this solution was placed in a reaction vessel with 2.0 ml of 50% alcohol solution

[1] This investigation was supported in part by research grants from the Division of Research Grants and Fellowships of The National Institutes of Health, U. S. Public Health Service, and The American Cancer Society.

[2] The author wishes to thank Dr. C. L. Gemmill for suggesting this problem and for his guidance in this study.

[3] Grateful acknowledgment is made to Dr. K. K. Chen, Lilly and Company, Indianapolis, Indiana, for the purified digitoxin used in this study.

and 0.5 ml of 0.2 *N* tetraethyl ammonium hydroxide. Nitrogen was bubbled through the solution for 15–20 min and the polarogram recorded. In this investigation, as in the study of the alcoholic solutions of digitoxin, multiple runs were made until a satisfactory height-versus-concentration curve was obtained and the average half-wave potential was calculated.

The results of these experiments show that digitoxin may be determined in concentrations as low as 0.1 μg in both alcoholic solutions and in blood. Multiple determinations run on concentrations between 0.1 and 0.4 μg of digitoxin in blood show the error in this method to be ±0.02 μg. Fig. 1 shows the height of polarographic break for various concentrations of digitoxin in alcoholic solutions and in blood extracts. This figure also shows the relationship between height of break for alcoholic and blood determinations. It may be seen that in concentrations down to approximately 0.6 μg the two curves coincide reasonably well; however, below this concentration the curve of digitoxin extracted from blood drops sharply and approaches zero. This drop from the alcoholic curve may be due to the distribution of digitoxin between the extraction solvent and blood at these low concentrations. The use of the arbitrary curve, although it varies from the curve of digitoxin in alcoholic solution, is based upon the results of multiple determinations which show a low error (± 0.02 μg) in the concentrations where the deviation is greatest. The average half-wave potentials were found to be − 1.965 in alcoholic solution and − 1.958 when extracted from blood.

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Effect of Sulfadiazine on Survival of the Mammalian Embryo[1]

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It has been shown by Detwiler, Copenhaver, and Robinson (*2*) that sulfadiazine in solutions of 1% or higher is frequently toxic to *Amblystoma* embryos in early developmental stages. More recently, Copenhaver and Detwiler (*1*) showed that 2% concentration of sulfadiazine caused a failure to survive to the stage of yolk resorption. They also observed abnormalities of various structures in the organism. S. Y. P'an (*4*) has shown that sulfamethiazine when administered to normal male rats produces gross and microscopic atrophic changes in the testes, seminal vesicles, and anterior prostate. Recently, Figge *et al.* (*3*) reported on the influence of sulfonamide drugs on cancer susceptibility, and reproduction in mice. He has observed that there is a decrease in reproduction in mice maintained on constant medication with certain sulfonamides. Two of the authors (Yntema and Hammond) have found that sulfadiazine is more lethal to chick embryos during the first half of the second day of incubation than it is subsequently. The drug appeared to interfere with the development of the vascular system. These studies suggested that sulfonamide administration might interfere with early development of the mammalian embryo.

TABLE 1

Expt. No.	Treatment*	Given on days	No. of mice	No. of deliveries (full term)	Percentage deliveries	χ^2	P
1	Untreated		56	27	48.2	7.64	0.0057
	Sulfadiazine†	5–15	56	13	23.2		
2	Untreated (isocaloric)		49	16	32.7	1.6	0.109
	Sulfadiazine	5–15	47	10	21.3		
3	Sulfadiazine	8–12	79	33	41.8	15.24	0.0001
	"	6–10	79	11	13.9	10.84	0.001
	"	10–14	79	29	36.7		
4	Sulfadiazine	6	109	15	13.8	23.18‡	
	"	7	104	15	14.4	22.39‡	

* Administered only in the diet in Experiments 1–3. In Experiment 4, one injection of 12 mg sulfadiazine sodium was given intraperitoneally, in addition to administration of sulfadiazine in the diet for the 6th or 7th day.

† Eight-tenths percent of diet.

‡ Compared with untreated controls in Experiment 1.

To investigate this, we selected white mice as our experimental animal and used sulfadiazine as a representative of the sulfa group of drugs. A diet of Purina dog chow containing 0.8% by weight of sulfadiazine was employed. The breeding cages contained four females and one male. Females were examined each morning. Those having vaginal plugs were removed, numbered, and placed in individual cages. Only the females showing vaginal plugs were selected for the investigation.

Experiment 1 (Table 1) represents the results obtained when such animals, beginning on the 5th day following conception, were fed sulfadiazine in the diet for a period of 10 days. The percentage of deliveries in this treated group was 23.2%, in contrast with 48.2% in the untreated control group. When untreated animals were fed isocalorically there was a reduction of deliveries, as indicated by the results of Experiment 2. However, this reduction did not reach the level noted in the sulfadiazine-treated animals.

It was of interest to localize more accurately the time at which the sulfonamide was effective. Experiment 3 indicates the results. Here it was shown that the period from the 6th to the 8th day was the one at which the sulfonamide was effective.

To localize further the most effective interval, Experiment 4 was conducted, in which animals were given sulfonamide for 1 day only. Here sulfadiazine sodium was

[1] This investigation was supported by a research grant from the Hendricks Fund at Syracuse University.

administered intraperitoneally, so that initial high sulfadiazine levels could be obtained. Following the intraperitoneal injection, the mice were placed on the sulfadiazine diet for 24 hr. Similar results were obtained whether sulfonamide was administered only on the 6th or only on the 7th day following appearance of the vaginal plug. No data have been obtained concerning the period from the 1st to 6th day.

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Enzymatic Reduction of 2,4-Diketo Acids Catalyzed by Dihydrodiphosphopyridine Nucleotide

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The reduction of pyruvic acid to lactic acid, catalyzed by dihydrodiphosphopyridine nucleotide ($DPNH_2$) in muscle extracts is well known. An apparently analogous reaction in which 2,4-diketo acids are reduced has been observed. When a series of homologous 2,4-diketo acids was incubated with 90% pure $DPNH_2$[1] and an aqueous extract of an acetone powder of rabbit muscle at pH 7.2, the characteristic absorption band of these compounds at 2900 A and the band due to $DPNH_2$ at 3400 A disappeared progressively. Equimolar amounts of coenzyme and diketo acid were utilized, suggesting the reduction of one keto group. In a typical experiment using a system containing 5×10^{-7} moles each of 2,4-diketovalerate and $DPNH_2$, 10^{-4} moles of phosphate buffer at pH 7.2, and 80 γ of protein nitrogen per 3 ml, 2.48×10^{-7} and 2.44×10^{-7} moles of $DPNH_2$ and diketo acid, respectively, disappeared after 12 min of incubation at 25° C. Neither $DPNH_2$ nor substrate disappeared when one of these was omitted from the system or in the absence of enzyme. No lactate was formed as determined by the method of Barker and Summerson (*1*), ruling out prior hydrolysis of the diketo acid to pyruvic acid (*3*). The facts are compatible with the equation,

$$RCCH_2CCOOH + DPNH_2 \rightarrow RCCH_2CHCOOH + DPN$$
$$\quad\;\; \| \quad \| \qquad\qquad\qquad\quad \| \quad |$$
$$\quad\;\; O \quad O \qquad\qquad\qquad\quad O \quad OH$$

whereby the product is considered tentatively to be the 2-hydroxy-4-keto acid.

The reaction proceeded more rapidly with increasing concentrations of substrate and was conveniently followed spectrophotometrically by measuring the rate of decrease of the $DPNH_2$ band at 3400 A. All of the normal 2,4-diketo acids from valeric to undecylic were reduced in the system, as shown in Table 1. Under the same experimental conditions, neither 4-keto valeric acid nor 3,5-diketohexanoic acid was reduced. The nature of the enzyme involved and its possible relationship to lactic dehydrogenase is under investigation.

TABLE 1

Enzymatic Reduction of 2,4-Diketo Acids*

2,4-Diketo acid	Disappearance of $DPNH_2$ (Moles $\times 10^{-7}$ per min)
n-Valeric	1.83
n-Hexanoic	1.74
n-Heptanoic	1.45
n-Octanoic	1.48
n-Nonanoic	1.36
n-Capric	1.33
n-Undecylic	1.45

* Composition of system in moles per 3 ml was 5×10^{-7} $DPNH_2$, 9×10^{-6} diketo acid, 1×10^{-4} phosphate buffer (pH 7.2); and 0.1 ml enzyme preparation (100 γ protein nitrogen) per 3 ml; 25° C. *

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A Convenient Quick Method of Obtaining Vitamin B_{12} Concentrate[1]

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The nonprotein filtrate of liver homogenate (proteins coagulated by boiling at pH 5.0) chromatographed on starch columns by the method of Moore and Stein (*1*) gave a reddish brown fraction in the first portions of the effluent.

The behavior and color of this fraction suggested a possible relation to B_{12}. This was tested as follows: 0.5 ml of liver injection, USP (Lederle Solution Extract, from beef liver, 15 u per ml) was dried by blowing air across it at room temperature. To the residue 0.1 ml 1*N* HCl was added, and then 0.5 ml of a mixture consisting of 0.1 *N* HCl, *n*-propanol, and *n*-butanol in the proportions 1:2:1. The solution was chromatographed on 25 g starch in a 10-mm × 300-mm column with the 1:2:1 mixture as solvent.

[1] This work is part of that done under a joint contract with the Office of Naval Research, United States Navy Department, and the United States Atomic Energy Commission.

[1] DPN was purified by countercurrent distribution as described by Hogeboom and Barry (2). Crude preparations tended to interfere with measurements made at 2900 A.
m = calibration factor for adrenalin

The first 4.2 ml of the effluent was colorless. The next 1.8 ml, fraction 1, was slightly colored; the next 1.8 ml, fraction 2, was deep reddish brown; a third 1.8 ml, fraction 3, was slightly colored. No more of the effluent, up to a total volume of 22.2 ml, was colored.

The three colored fractions were submited to Karl Folkers, of Merck and Company, for analysis. He reported the following: fraction 1, 80 microbiological units per mg; fraction 2, 2000 units per mg; fraction 3, 240 units per mg.

As the color accompanies the activity, it is easy to know what portion of the effluent to collect. The method offers a way of obtaining B_{12} active material from commercially available sources, which already contain the activity in a conveniently small volume.

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Fat Absorption and Atherosclerosis[1]

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In our work on the effect of age on fat absorption (*1*) we have observed a phenomenon which may be fundamental in the pathogenesis of atherosclerosis.

Using a modification of Frazer's chylomicron dark field technique (*1, 2*), we have studied the absorption of fat in thirty young and in thirty old subjects with average ages of 18 and 76 years respectively. The fasting subjects were given a standard fat meal of ½ g of oleomargarine/kg of body weight on 2 oz of white toast together with a cup of tea. Samples of finger blood were drawn before and after the meal at regular intervals as indicated in Fig. 1. The number of chylomicrons in the serum of each specimen was determined and chylomicrographs were constructed.

As shown in Fig. 1, the chylomicron counts of young subjects reached a peak at 2½–3 hr, and returned to fasting levels by the end of the 5th hr. The counts of the old group on the other hand did not reach their peak until 9–12 hr, and they did not return to fasting levels until 24 hr had elapsed. In addition, the total number of chylomicrons was found to be consistently and considerably higher in the old than in the young group.

Previous work by Gage and Fish (*4*), and Frazer (*2*) has established that the chylomicron curve serves as an index of postabsorptive lipemia. From our results it is obvious that a definite delay in the rate of absorption and a definite increase in the total absorption of corpuscular fat exist in aged individuals as compared with a group of young subjects.

The observations of Hueper (*6, 7*) and of Moreton (*9, 10*) seem to indicate that the alimentary hyperlipemia and its accompanying high concentrations of chylomicrons

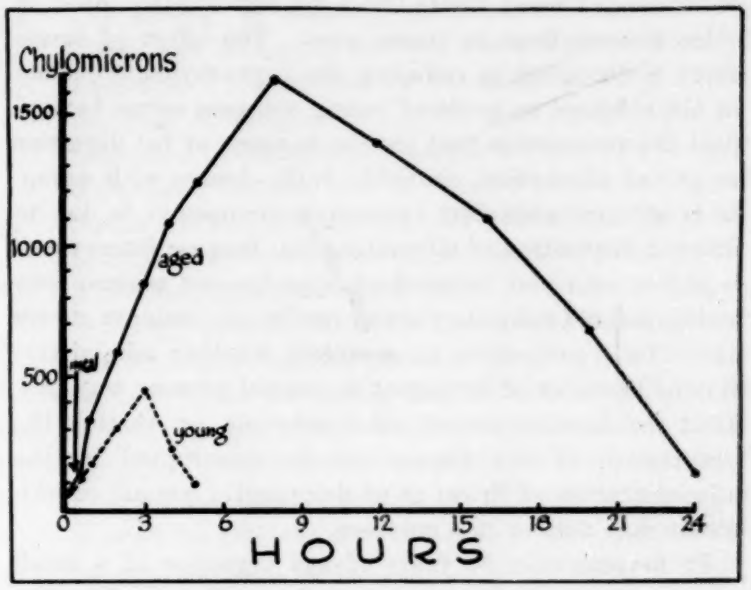

Fig. 1.

in the peripheral blood, occurring in normal individuals, are indistinguishable from the sustained hyperlipemia and hyperchylomicronemia of pathological and experimental origin which have been found to be characteristic of the known causative conditions of atherosclerosis.

Hueper (*6, 7*) and Moreton (*9, 10*) state that macromolecular substances can be deposited and can damage the internal layers of arteries. Chylomicrons are macromolecular bodies containing largely neutral fat and some cholesterol (*2, 3, 9, 10*). The neutral fat, according to Moreton (*9, 10*), disappears rapidly from the intima and subintima, while the cholesterol remains and accumulates gradually, attracting macrophages, giving rise to foam cells, and ending in atherosclerosis.

The question is still controversial, whether endogenous or alimentary cholesterol produces atherosclerosis in man. This cholesterol is in true solution and it is possible that chylomicrons, which are macromolecular aggregates, are the source of irritation and degeneration of arterial walls, rather than cholesterol, fats, or other lipids in the dissolved state (*6, 7, 9, 10*). In the chicken, endogenous cholesterol seems to play a large role in the genesis of arteriosclerosis (*5*).

Increased chylomicronemia following fat-containing food occurs at every age. However, it lasts only a relatively short time and it is only of moderate intensity in young persons. With increasing age, and particularly above 50 years of age, chylomicronemia is of greater intensity and it is practically permanent. If the chylomicrons play a role in atherosclerosis, the fundamental physiological basis of the mechanism of the disease may lie in this fact.

Another significant observation made was that oral ad-

[1] Aided by a grant from the A. B. Kuppenheimer Fund. The department is in part supported by the Michael Reese Research Foundation. The help of Dr. H. Sorter, Medical Director, of Mr. B. Grossman, Director, and of the staff of the Home for Aged Jews is acknowledged gratefully. We are obliged to Dr. B. M. Kagan and the staff of Sarah Morris Hospital for their cooperation.

ministration of lipase[2] or of a detergent (Tween 80)[3] with the fat meal reduced the hyperchylomicronemia of older persons to practically the level of the younger age group. The chylomicron count in young persons following a fat meal was not influenced materially by the administration of lipase with the fat meal.

We have found earlier (*11*) that pancreatic lipase secretion and blood lipase levels are significantly lower in older persons than in young ones. The effect of lipase or of a detergent in reducing the hyperchylomicronemia in old subjects to levels of young subjects seems to support the assumption that the mechanisms of fat digestion or of fat absorption, probably both, change with aging. It is not probable that hyperchylomicronemia is due to delayed disposition of circulating fat, because intravenous injection of equal volumes of hyperlipemic plasma into young and old subjects yielded similar chylomicron curves (*1*). It is premature to speculate whether administration of lipase or of detergent to normal persons may prohibit the development of atherosclerosis, or whether the progression of the disease can be interrupted by the administration of lipase or of detergent. Animal experiments may answer this question.

In persons over 50 years of age ingestion of a small amount of oleomargarine was followed by a practically 24 hr increase in the chylomicron count in the serum. In younger persons the chylomicron curve returned to fasting levels within 5 hr. Since all people eat some fat at least once a day, increased numbers of fat particles circulate in the blood of older persons practically permamently. If it is true that particulate fat, circulating in the blood, leads to atherosclerosis, the condition leading to that degenerative disease has been found.

Administration of lipase or of detergent with the fat meal reduced the chylomicron counts and the duration of increased counts of old subjects to levels of young subjects.

Work on animals will show whether atherosclerosis can be influenced by drugs affecting digestion and absorption of fat.

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[2] Kindly supplied by Dr. D. Klein, Wilson Company, in the form of concentrated pancreatin.

[3] Kindly supplied by Dr. G. R. Hazel, Abbott Laboratories.

A Vibrating Tissue Slicer[1]

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Some recent studies (*5*) of the metabolism of brain cortex slices required six or eight parallel experiments on the same brain. Neither the freehand method (*4*), nor the microtome method (*3*) yields sufficient material from brains of guinea pigs or rabbits. We have found that a vibrating blade with freehand manipulation can provide 500 mg of cortex slices from a full-grown guinea pig brain. The source of vibration is a mechanical wood carving tool (Burgess Vibro-Tool), which develops a push-pull vibration at a frequency of 120 per sec. There is only slight lateral vibration. In the chuck, we fastened

TABLE 1

	Hand cut		Cutter	
	Wet weight in mg	Qo_2	Wet weight in mg	Qo_2
Mouse liver	122	5.77	78	6.08
	94	6.28	82	5.58
	112	5.79	92	6.06
Average		5.95		5.91
Guinea pig brain cortex	52	9.18	57	10.20
	72	9.72	71	9.20
	53	10.10	63	9.50
Average		9.67		9.63

a split metal adapter tightened by a wing nut, which can hold 2-in. pieces of Stadie blades or single-edge razor blades.

The platform upon which the cerebral hemisphere is placed is made by filling a 50-mm crystallizing basin with ice and water to overflowing, sliding the bottom of a larger basin over it, and inverting the basins. The ice floats to the top, causing the platform to be chilled. The cerebral hemisphere, with meninges and blood vessels removed, is placed on a small square of moistened filter paper on this platform.

The cutter, with the edge facing the operator, is grasped firmly in both hands, one arm resting on the table edge for added stability. The vibrating blade is drawn slowly through the tissue, toward the operator, with a wrist motion. The slice lies flat on the blade, and the plane of the cut can be varied for thickness of slice and for contour of the tissue without the necessity of guiding and sawing simultaneously, which is inherent in the freehand method. The slice can be picked off the blade with a fine forceps or can be removed by dipping the vibrating blade into a small beaker of chilled Ringer's solution. The blade must be moistened slightly if the

[1] This work has been supported in part by the Office of Naval Research and the International Minerals and Chemical Corporation.

slicing is to be done in the open, but need not be moistened in the humid box of Sperry (*2*) or the moist cold box of Fuhrman and Field (*1*).

There is no apparent change in the tissues induced by the low frequency vibration of the blade, as measured by the 1-hr oxygen uptake of comparative portions of the same organ sliced by hand (*4*) and by the vibrating cutter, as shown in Table 1. The medium used was Kreb's Phosphate Ringer's, pH 7.4, at 37° C, with air atmosphere. The brain medium also contained .011 molar glucose.

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The Chemical Nature of a Factor in Hog Stomach Extracts that Reduces the Creatinuria of Muscular Dystrophy[1]

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A labile factor, assayed by its effect on lowering the creatinuria of a patient with progressive muscular dystrophy, has been found to concentrate in the fat fraction (*7*) of hog gastric mucin[2] and of hog stomach linings[3]. But attempts at further fractionation of this concentrate by countercurrent distribution between absolute methanol and isooctane led to a rapid loss of biological activity. The crude fat fraction contained up to 1%[4] of a substance which reduced ferric chloride in a modified Emmerie and Engel (*1*) assay. This reducing property proved to be a measure of biological activity, since loss in biological activity was associated with a decrease in amount of reducing substance. None of the four naturally occurring tocopherols, which also reduce ferric chloride in the assay of Emmerie and Engel, could have accounted for the biological activity, since they were without effect on the creatinuria of this patient at doses 25 times the active dose of reducing substance from stomach extracts. Alpha (*6*), beta, and gamma tocopherols (*4*), however, do abolish the creatinuria of the muscular dystrophy of experimental vitamin E deficiency.

The fat fraction of hog gastric mucin which lowered creatinuria at a dosage of 100 mg was allowed to lose activity by standing at room temperature for 3 months. The amount of reducing substance fell from 0.77% to 0.07% and biological activity was completely lost. This suggested a destruction by autoxidation which leads, in the case of tocopherols in the presence of fats, to the formation of tocopheryl-*p*-quinones (*6*). The tocopheryl-*p*-quinones, in turn, can be reduced to the corresponding tocopheryl-*p*-hydroquinones and cyclized in the presence of mineral acid to regenerate the original tocopherols (*5*). The following experiments, which were designed to regenerate any tocopherols in the inactivated fat fraction that had undergone autoxidation and tocopheryl-*p*-quinone formation, led to the finding that an intermediate in the reaction, a simple reduction product, possessed chemical and biological properties similar to the factor in the fat fraction of hog gastric mucin. A 100-mg portion of inactivated fat fraction was refluxed for 2 hr in an isooctane-ethanol mixture containing 5.0 g stannous chloride and 5.0 ml concentrated HCl. After addition of water and recovery of the isooctane layer, the amount of reducing substance was found to have increased to 1.08% and remained stable at this value. A 225-mg dose of this material containing 2.43 mg of reducing substance had no effect on creatinuria. A control experiment with pure alpha tocopheryl-*p*-quinone under the same conditions showed complete conversion to alpha tocopherol ($E\,^{1\%}_{1\,cm}$ [298 mμ] in isooctane = 70; $E\,^{1\%}_{1\,cm}$ [520 mμ] in the Emmerie and Engel assay = 370). Another 100-mg portion of inactivated fat fraction of gastric mucin was refluxed for 30 min in the same solvent with 0.7 g stannous chloride and 0.5 ml concentrated HCl, and the isooctane layer was recovered as described. The reducing substance had increased to 0.73% but fell to 0.30% on the second day, 0.27% on the third day, and to 0.21% by the end of a week. A 225-mg dose of this material, containing 1.03 mg of reducing substance, was biologically active. The control with pure alpha tocopheryl-*p*-quinone under these conditions showed the formation of alpha tocopheryl-*p*-hydroquinone by the appearance of an absorption maximum at 290 mμ which disappeared in the course of 18 hr, as the spectrum of alpha tocopheryl-*p*-quinone reappeared with a double maximum between 260 and 270 mμ. This rapid autoxidation is characteristic of alpha tocopheryl-*p*-hydroquinone, first described by John (*5*). The creatinuria-lowering activity of the fraction of gastric mucin treated in this way was fully duplicated by 1.0 mg of pure synthetic alpha tocopheryl-*p*-hydroquinone.

Alpha tocopheryl-*p*-hydroquinone was prepared as needed from the more stable alpha tocopheryl-*p*-quinone by catalytic hydrogenation in ethanol or propylene glycol with palladium on calcium carbonate. The $E\,^{1\%}_{1\,cm}$ (290 mμ) in isooctane was 88 immediately after hydrogenation, a value somewhat higher than that reported by John (*5*). The $E\,^{1\%}_{1\,cm}$ (520 mμ) in the Emmerie and Engel assay was

[1] This work has been aided by the Armour Fund for Research in Muscular Disease and by a grant from the Nutrition Foundation.

[2] Frederick Stearns and Company. Prepared by alcoholic precipitation of an acid digestion of hog stomach linings.

[3] A low temperature concentrate of an acetone extract of hog stomach linings was kindly furnished by the Armour Research Laboratories.

[4] Calculated from a standard curve for alpha tocopherol.

390. Alpha tocopheryl-*p*-quinone was prepared by the oxidation of natural or synthetic alpha tocopherol with ferric chloride (*2*) and purified by the method of Tishler and Wendler (*8*) to an $E\,\frac{1\%}{1\ cm}$ (268 mμ) in isooctane of 450.

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Taste Blindness to Phenyl-Thio-Carbamide as a Function of Saliva

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In 1931, A. L. Fox (*6, 7*) of the E. I. du Pont de Nemours Company discovered that approximately 60% of the Causasian population are able to taste phenyl-thio-carbamide (P. T. C.) as bitter, while the remaining 40% find it to be as tasteless as chalk. The literature of the physiological, genetic, environmental, and ethnological characteristics of this phenomenon has been reviewed by Cohen and Ogdon (*3*).

Blakeslee (*1*), Fox (*4*), Mee (*5*), and Blakeslee and Salmon (*2*) have all suggested that it may be the saliva which is the determiner of the ability to taste or not, and not the "taste apparatus" itself. Fox specifically suggested the possibility that nontasters have in their saliva a product, possibly a protein or a colloid, which precipitates the P. T. C. as a very insoluble substance which does not give rise to a taste sensation.

The question as to the effect of the saliva may be settled by allowing tasters and nontasters to taste P. T. C. using another taster's or nontaster's saliva. A population of 35 American college students was first tested with P. T. C. crystals and each individual classified as a taster or a nontaster. Then each person (whether taster or nontaster) was tested with each of the following tests: 1) D test, using a saturated solution of P. T. C. in tap water on a dry (dried by air from an atomizer) tongue; 2) G test, using a saturated solution of nontaster's saliva on a dry tongue; 3) P test, using a saturated solution of P. T. C. in taster's saliva on a dry tongue. The taster's and nontaster's saliva was obtained from other individuals selected purely at random. No saliva from any person was used for more than one test on more than one subject. The results are given in Table 1.

As a control, 19 individuals were tested with the R test, using saturated solutions of P. T. C. in their own saliva, which had been allowed to remain exposed to air about 5–10 min, on a dry tongue. The results are given in Table 2.

TABLE 1

Sensations of 35 Observers to P. T. C. Dissolved in Water, and Taster's and Nontaster's Saliva on a Dry Tongue

	D Test	G Test	P Test
26 Tasters*	T = 0 NT = 26	T = 0 NT = 26†	T = 0 NT = 26
7 Nontasters	T = 0 NT = 7	T = 0 NT = 7	T = 0 NT = 7‡

T = tastes bitter.
NT = no taste.

* Four subjects reported only weak taste of bitter.
† One subject reported slight sensation, but was unable to describe it.
‡ One subject reported a "warm" sensation.

These data seem to indicate that an individual will taste P. T. C. as bitter when the following two necessary conditions are met: 1) He must have the correct "taste apparatus," and 2) he must have his own saliva (or, presumably, its chemical equivalent). A nontaster cannot taste in any event, even when he uses the saliva of another taster. A taster cannot taste under any circumstances, except when he uses his *own* saliva; he cannot taste if he uses the saliva of another taster or nontaster. He can taste if he uses his own saliva, even though the saliva is placed on his tongue in exactly the same manner as the saliva from another individual. No subject can taste P. T. C. when the crystals are dissolved in water and no saliva is used at all.

TABLE 2

Sensations of 19 Observers to P. T. C. Dissolved in Their own Saliva on a Dry Tongue

	R Test
17 Tasters	T = 16 NT = 1*
2 Nontasters	T = 0 NT = 2

* This subject had previously reported a weak bitter taste to the crystals.

Salivas are probably as different as fingerprints. Blakeslee and Salmon (*2*) have also found that saliva is important to taste P. T. C. Our finding that it must be the individual's own saliva may be brought about by the fact that the "taste apparatus" becomes, over the years, extremely sensitive and specialized to the particular saliva which the individual possesses; or these differences in saliva may be congenital or genetic. This being the case, when other saliva is introduced, it is equivalent to water, and no taste sensation results.

As a check on whether saliva influences other tastes, 27 observers were tested with saturated solutions (in water) of saccharin and salt on dry tongues, and on tongues wet with saliva. All of the individuals were able

to taste both the salt and the saccharin using wet tongues, but 16 failed to detect the saccharin and nine failed to detect the salt with a dry tongue. Apparently, therefore, saliva aids in many taste sensations, but its effect is most pronounced with P. T. C.

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Sex Influence on Embryonic Death Rate in Chicks

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Thornton (*7*) reported evidence from this laboratory that the death rate in chick embryos up to 5 days of age was greater in females than in males. Landauer and Landauer (*5*) in summary data showed that the sex ratio of chicks at hatching was 48.77. Byerly and Jull (*1*) reported the sex of embryos that died after 9 days of incubation to be 48.59% males. These data would suggest that the mortality rate during this period was higher in females. Hays (*2*) gave the sex ratio in chicks at 8 weeks of age as 50.85% males. Hays (*3*) showed that the primary sex ratio in chickens is about 50–50, with considerable variation between families. In general, observations of different workers suggest that there may be considerable variation between breeds and strains with respect to sex ratio (*6*).

Data collected in the spring of 1949 on the Massachusetts Experiment Station flock of Rhode Island Reds strongly indicate that among embryonic deaths up to 5 days of incubation there is a higher incidence in females than in males. In the fowl the female is the heterogametic sex, and the reduced ratio in females corresponds to the reduced ratio of males reported for most animals where the male is the heterogametic sex.

The data presented in the table include 5450 eggs set in six weekly hatches, including eggs laid from February 5 to March 25, there being a 1-week interval in which eggs were not saved between the third and fourth hatches.

TABLE 1

Hatch	Egg production	Total embryonic mortality %*	Early embryonic mortality %†	Sex ratio at 8 weeks
1	1337 (F5–11)	20.5	19.8	50.0
2	1238 (F12–18)	27.5	28.7	50.0
3	1097 (F19–25)	32.4	55.0	56.6
4	991 (M5–11)	20.8	32.5	52.8
5	948 (M12–18)	24.1	31.1	53.4
6	921 (M19–25)	27.6	38.4	56.5

* Based on fertile eggs.
† Percentage of embryos that died early.

A very mild epidemic of bronchitis appeared in the breeding pens soon after the collection of hatching eggs began. This disease outbreak caused a linear decline in production during the period, in contrast to the normal rapid increase expected at this season (*4*). Effects of the disease were observed both on fertility and embryonic death rate. Sex of the chicks was not determined until they were 8 weeks of age, but the postincubation death rate was low in the 3200 chicks retained.

The table shows that total embryonic mortality did not increase greatly through the hatching season, but the early embryonic death rate almost doubled as the season progressed. This observation suggests that the disease virus had a lethal effect which operated early in the development of the chicks. The last column gives the percentage of survivors at 8 weeks of age that were of the male sex. The abnormally high percentage of males from the last four hatches strongly indicates that the majority of embryos that died early must have been females. These data, together with those of Byerly and Jull (*1*), show that the embryonic death rate in females is higher than in males, at all stages of embryonic development.

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Book Reviews

Pharmacology and toxicology of uranium compounds: With a section on the pharmacology and toxicology of fluorine and hydrogen fluoride. (National Nuclear Energy Series, Div. VI, Vols. 1 and 2.) Carl Voegtlin and Harold C. Hodge. (Eds.) New York: McGraw-Hill, 1949. (Illustrated.) Vol. 1: pp. xvii + 524; Vol. II: pp. 525–1084. $10.00.

These volumes are part of the National Nuclear Energy Series prepared as a record of the research work done under the Manhattan Project and the Atomic Energy Commission. They represent the comprehensive experimental studies carried out by a considerable group of investigators in the Division of Pharmacology of the Manhattan Department of the University of Rochester on the pharmacology and toxicology of uranium. Prefaces and forewords outline the history of the volumes, the nature of the problem undertaken, and the proposed attack; only casual mention is made of the peculiar difficulties of war research.

The urgency of the problem—the toxicity of uranium compounds—resulted in the formation of a large organization that sought information of immediate practical value. While the applied science approach was dominant, much work of a more fundamental nature was undertaken in order to understand the nature of uranium poisoning and to provide possible avenues toward diagnosis, prophylaxis, and therapy. The studies utilized several species of animals in order to permit generalization of the conclusions to include man. To encompass the possible modes through which man might become poisoned, experiments were performed with many uranium compounds and the principal modes of experimental exposure: inhalation, ingestion, subcutaneous and intravenous injection, and application to the skin or eye. There are also studies on human exposure to uranium compounds. The characteristic changes of uranium poisoning are presented from clinical, histopathological, and biochemical viewpoints. The distribution and excretion of uranium under various conditions, the nature of acquired tolerance to uranium poisoning, and the effect of uranium compounds on enzymes and proteins were also investigated.

Many of the methods employed were originated or adapted by the Rochester group, and are presented in detail. Most of these might be useful to investigators in other problems in pharmacology and toxicology. This is particularly true of the methods used in the inhalation studies, which are presented in an excellent and exhaustive chapter. Inasmuch as fluorine and hydrogen fluoride are of increasing industrial importance, the chapter on the toxicity of these substances should be especially valuable.

The presentation of the material, both conceptual and factual, is lucid and thorough, and use is made of charts and figures where feasible. Interpretations wander away from facts infrequently, proofreading errors are few, and "scientific shorthand" is kept to a minimum. These volumes were not intended as a textbook, but should be of value to toxicologists and pharmacologists generally. They are the most comprehensive studies on the pharmacology and toxicology of uranium ever published.

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Physikalische Chemie in Medizin und Biologie. (2nd ed.) W. Bladergroen. Basle, Switz.: B. Wepf & Co., 1949. Pp. xxiv + 675. (Illustrated.) 45 Sw. fr.

"Zwischen zwei Stühlen zu sitzen ist sicher keine angenehme Situation," so writes M. Roch, of Geneva, in his introduction to this book. He is referring to the position in which he says many physicians find themselves today in respect to their practice and teaching of medicine as it relates to the applications of physical chemistry. Apparently the basic training of physicians in Switzerland is as devoid of physical chemistry as it is in our own. This book, like many others on the market, has been written mainly in an attempt to rectify this deficit in our medical training program. The author is vice president of Sandoz, Ltd. in Basle, Switzerland.

The first five chapters deal largely with those basic chemical and physicochemical concepts which find an extensive application to biology and medicine. They deal with such topics as the structure of matter, kinetics and energetics, radiations, nuclear physics, and properties of aqueous solutions. Chapter six treats of acid-base equilibrium in the animal body. The next five chapters are concerned chiefly with surface phenomena and colloidal solutions. Two of the five chapters are devoted largely to a description of the basic principles involved and the others mainly to the fine structure of protoplasm, permeability, and osmotic pressure relationships within the animal body. The book concludes with chapters on oxidation reduction potentials and biological oxidations, between which, rather oddly, is sandwiched a chapter on metabolism.

In general, the author appears to have performed a commendable job. His treatment of the various topics is extensive enough to avoid being superficial and he has not refrained from the use of the necessary mathematics. Those who are able to read German with ease will find this book worth consulting when they wish to clarify some aspects of the role of physical chemistry in biology and medicine.

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Scientific Book Register

ADAMS, ROGER *et al.* (Eds.) *Organic reactions.* (Vol. V.) New York: John Wiley, 1949. Pp. viii + 446. $6.00.

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The New York Meeting, AAAS

December 26–31, 1949

AAAS Special Sessions

One of the features that characterize the Association's Annual Meetings is a series of general lectures and addresses, frequently sponsored by organizations that meet regularly with the AAAS, and open to the general public of the city in which the meeting is held. The series will be continued this year, with several notable additions. All but one of the lectures are scheduled for the Grand Ballroom of the Hotel Statler, the largest available room. Since these sessions are not restricted to registrants, and the capacity of the ballroom is limited, early arrival is advisable.

The presidential address, by retiring president Edmund W. Sinnott, director of the Sheffield Scientific School, Yale University, will be held Wednesday evening, December 28, at the Grand Ballroom of the Hotel Statler, at 8:00 p.m. His subject will be "Ten Million Scientists." Elvin C. Stakman, President of the Association, will preside. G. B. B. M. Sutherland, official representative of the British Association for the Advancement of Science, and officers of the AAAS will be seated on the platform. Members of the Honorary Reception Committee will have reserved seats. The presidential reception that follows this address is open to all registrants. The speaker, officers of the Association, and members of the Honorary Reception Committee will be in the receiving line.

The address by G. B. B. M. Sutherland, of the British Association for the Advancement of Science, "The Growing Importance of Infrared Studies in Physics, Chemistry, and Biology," will be held in the Grand Ballroom of the Statler, on Wednesday afternoon, December 28, at 4:30 p.m. An exchange address by an official representative of the BAAS, which antedates the AAAS by 17 years, has come to be traditional, and significant of the ties between scientists throughout the world. This year Dr. Sutherland is professor of physics in the Harrison M. Randall Laboratory of Physics, University of Michigan; last year he was reader in spectroscopy and fellow of Pembroke College in the University of Cambridge. His recent election as Fellow of the Royal Society was for his distinguished work in infrared physics at Cambridge.

The Josiah Willard Gibbs lecturer this year will be Norbert Wiener, of the Massachusetts Institute of Technology, who will speak on "The Mathematics of Sensory Prosthesis." This mathematics lecture, sponsored by the American Mathematical Society, will be held at McMillan Theatre, Columbia University, on Wednesday afternoon, December 28, at 4:30 p.m.

The National Geographic Society's annual lecture will be held Tuesday afternoon, December 27, at 3:00 p.m. in the Statler's Grand Ballroom. Those who have attended these illustrated lectures before know their excellence. This year's speaker will be Frank M. Setzler, head curator of the Smithsonian's Department of Anthropology, who was coleader last year of an expedition to Arnhem Land in Australia, sponsored jointly by the National Geographic Society, the Smithsonian Institution, and the Commonwealth of Australia (see *Science*, May 20, page 528). With a sound film in color, Dr. Setzler will describe the customs of the little-known aborigines of Arnhem Land, and also its topography, fauna, and flora.

The Scientific Research Society of America, recently organized by The Society of the Sigma Xi, offers as speaker for its first annual lecture John R. Dunning, Columbia University's distinguished physicist, who will speak on "Recent Advances in Nuclear Physics." George A. Stetson, editor of *Mechanical Engineering*, and chairman of RESA, will preside at this session, which will be held Monday evening, December 26, at 8:00 p.m. in the Statler's Grand Ballroom.

One of the outstanding features every year is the annual address of The Society of the Sigma Xi. This year it will be made by Theodosius Dobzhansky, Columbia University zoologist and author of *Genetics and origin of species*. Dr. Dobzhansky has recently returned from South America and the subject of his illustrated lecture will be "Evolution in the Tropics." George B. Pegram, vice president of Columbia University and president of The Society of the Sigma Xi, will preside at the session, to be held in the Statler Grand Ballroom, Tuesday evening, December 27, at 8:00 p.m.

There will be an important forum on "Research and National Security" in the Statler's Grand Ballroom, Thursday, December 29, at 10:00 a.m. Detlev W. Bronk, president, The Johns Hopkins University, will preside; the speakers will include representatives of the armed forces and the AEC.

AAAS Exhibits

The AAAS Annual Science Exposition, larger and more diversified than ever before—70 exhibitors, 86 booths—will be held throughout the week in the Penn Top and Salle Moderne, on the 18th floor of the Hotel Statler, and is open to all adults. Hours are 2:00 p.m. to 6:00 p.m. Monday; 9:00 a.m. to 6:00 p.m. Thursday and Friday; 9:00 a.m. to 9:00 p.m. Tuesday and Wednesday; and 9:00 a.m. to 12:00 m. Saturday. The exhibits will be listed and described in the Preconvention Issue of *Science*.

Science-teaching exhibits will be displayed all day Thursday, December 29, in the Hotel New Yorker's Grand Ballroom. There will be two sets of exhibits: (1) materials and devices found useful in science teaching by science teachers in New York City; and (2) materials of interest to science teachers, arranged by scientific institutions in and near New York City.

Visual displays illustrating the principles of television, set up by the New York Section of the American Institute

of Electrical Engineers jointly with AAAS Section M, will occupy the East Room of the Hotel McAlpin for three days, Wednesday, Thursday, and Friday, December 28, 29, and 30.

Exhibits of the American Society of Human Genetics will be on display all week in adjoining Parlors J and F, Hotel Governor Clinton.

Technical demonstrations of three biological societies will be on display: American Society of Parasitologists—Schemerhorn Hall, Rooms 864, 903–913, Columbia University, Wednesday afternoon, December 28, 2: 30–5: 00 p.m.; American Society of Zoologists—Schemerhorn Hall, Rooms 652–654, Columbia University, Thursday afternoon, December 29, beginning 2: 00 p.m.; Genetics Society of America—Schemerhorn Hall, Rooms 903–913, Columbia University, Thursday afternoon, December 29, beginning 2: 00 p.m.

AAAS Symposia

Several symposia, joint meetings, and panel discussions that explore relatively neglected areas of scientific inquiry, or survey current knowledge in a given field, are designated AAAS-sponsored symposia. Such programs are helpful because they summarize the present status of research, focus attention upon critical points, and give direction to further research. Scientists well established in their fields and younger specialists have come to anticipate AAAS symposia and they have become an increasingly important aspect of the annual meetings of the Association. Not infrequently, such papers are gathered into symposium volumes. Typically, these programs originate in the minds of the able officers of the Association's sections and are developed by them, individually or by committees. This year the Symposium Committee is composed of President Elvin C. Stakman, chairman; General Secretary Karl Lark-Horovitz; Walter C. Miles; and Assistant Administrative Secretary, Raymond L. Taylor, secretary.

The problem of scheduling these symposia—several of them requiring four sessions—with a minimum of interference with the regular paper-reading sessions of the participating societies, this year has largely been solved by grouping most of them on two successive days, Thursday and Friday, December 28 and 29. Even this, however, has required the cooperation of the societies. It is planned for 1950 that all Association-sponsored symposia shall be grouped at the beginning or end of the six-day period of the meetings—an obvious advantage to those who may be particularly interested in the sessions of the participating societies or the symposia and no disadvantage to those who elect to stay for both.

The ten Association-sponsored symposia of 1949 comprise:

1. Trends in Modern Science

Tuesday morning, December 27, Grand Ballroom, Hotel New Yorker, at 10: 00 a.m. Arranged jointly by AAAS Cooperative Committee, American Nature Study Society, National Association of Biology Teachers, National Science Teachers Association; *Karl Lark-Horovitz*, head, Department of Physics, Purdue University, and General Secretary of the AAAS, in charge and presiding. Speakers: *Lawrence L. Quill*, head, Department of Chemistry, Michigan State College; *Lincoln V. Domm*, Department of Zoology, University of Chicago; and *Elvin C. Stakman*, chief, Division of Plant Pathology and Botany, University of Minnesota.

2. Science in General Education

Thursday afternoon, December 29, Grand Ballroom, Hotel Statler, at 1: 30 p.m. Arranged by the AAAS Cooperative Committee, *Karl Lark-Horovitz*, head, Department of Physics, Purdue University, in charge and presiding. Speakers: *Earl McGrath*, Commissioner of Education, U. S. Office of Education; *Paul B. Sears*, chairman, Department of Botany, Oberlin College; *Morris Meister*, principal, Bronx High School of Science; and *Karl Lark-Horovitz*, head, Department of Physics, Purdue University.

3. Improvement of Science Instruction on the College Level: A Panel Discussion

Thursday afternoon, December 29, Grand Ballroom, Hotel Statler, 3: 30 p.m. *Elvin C. Stakman*, chief, Division of Plant Pathology and Botany, University of Minnesota, and President of the AAAS, in charge and presiding. Speakers: *James B. Conant*, president, Harvard University; *W. F. Loehwing*, head, Department of Botany, University of Iowa; *Fernandus Payne*, chairman, Department of Zoology, dean of the Graduate School, University of Indiana; and *Alan Gregg*, director of medical science, Rockefeller Foundation.

4. The Present State of Physics

Arranged by *F. S. Brackett*, chief, Low Energy Radiation Biology Section, National Institutes of Health, and Secretary of the AAAS Section B—Physics. Four sessions.

1. Elementary Particles. Thursday afternoon, December 29, Georgian Room, Hotel Statler, at 2: 00 p.m.; *Gregory Breit*, Physics Department, Yale University, presiding. Speakers: *P. Kusch*, Department of Physics, Columbia University; *E. P. Ney*, Physics Department, University of Minnesota; and *Jabez C. Street*, Physics Department, Harvard University.

2. Physics of the Solid State. Friday morning, December 30, Georgian Room, Hotel Statler, at 9: 30 a.m.; *F. S. Brackett*, presiding. Speakers: *Karl Lark-Horovitz*, head, Department of Physics, Purdue University; *John W. Bardeen*, Bell Telephone Laboratories; and *Arthur R. Von Hippel*, Department of Electrical Engineers, Massachusetts Institute of Technology.

3. Chemical Physics. Friday afternoon, December 30, Georgian Room, Hotel Statler, at 1: 30 p.m.; *Sterling Hendricks*, U. S. Bureau of Plant Industry, presiding. Speakers: *Peter W. Debye*, Baker Chemical Laboratory, Cornell University; and *Henry Eyring*, dean, Graduate School, University of Utah.

4. Biophysics. Friday afternoon, December 30, Georgian Room, Hotel Statler, at 3: 30 p.m.; *Kenneth S. Cole*, Naval Medical Center, Bethesda, presiding. Speakers: *Frank Brink, Jr.*, Department of Biophysics, The Johns Hopkins University; and *F. H. Johnson*, Department of Biology, Princeton University.

5. Steroid Hormones and Sex Differentiation in Vertebrates

Friday afternoon, December 30, Grand Ballroom, Hotel Statler, at 2:00 p.m. Arranged by *J. H. Bodine*, head, Department of Zoology, University of Iowa and Secretary of AAAS Section F—Zoology, and *L. V. Domm*, Whitman Laboratory of Experimental Zoology, University of Chicago. *Roland K. Meyer*, University of Wisconsin, presiding. Speaker: *Emil Witsch*, Department of Zoology, University of Iowa; Discussants: *Clifford Grobstein*, National Cancer Institute, and *W. J. Eversole*, Syracuse University; Speaker: *L. V. Domm*, Whitman Laboratory of Experimental Zoology, University of Chicago; Discussant: *B. H. Willier*, director, Biological Laboratories, The Johns Hopkins University. Speaker: *C. R. Moore*, Whitman Laboratory of Experimental Zoology, University of Chicago; Discussant: *R. K. Burns, Jr.*, Department of Embryology, Carnegie Institution, Baltimore.

6. The Kinsey Report and its Contributions to Related Fields

Friday evening, December 30, Grand Ballroom, Hotel Statler, at 8:00 p.m. Arranged by *J. H. Bodine*, head, Department of Zoology, University of Iowa, Secretary of AAAS Section F—Zoology; *George W. Corner*, Carnegie Institution, Baltimore, presiding. The speakers on this critique of the Kinsey Report are: *Morris L. Ernst* of the New York law firm, Greenbaum, Wolff and Ernst, for the field of law; *Ralph Linton*, Department of Anthropology, Yale University, for anthropology; *Hugh J. Parry*, the Anti-Defamation League, New York City, for the field of statistics; and *Manfred S. Guttmacher*, chief medical officer, the Court House, Baltimore, Maryland, and also chairman of the American Psychiatric Association Committee on Legal Aspects of Psychiatry, for the field of psychiatry.

7. Botany in the Service of Man: A Panel Discussion

Thursday afternoon, December 29, Winter Garden, Hotel McAlpin, at 2:00 p.m. Arranged by *Stanley A. Cain*, botanist, Cranbrook Institute of Science, and Secretary of the AAAS Section G—Botany; *William C. Steere*, chairman, Department of Botany, University of Michigan, and Chairman of AAAS Section G, moderator. Speakers: *Hazel K. Stiebeling*, in charge of the Food Economics Section, Bureau of Home Economics, U. S. Department of Agriculture; *S. T. Dana*, dean, School of Forestry and Conservation, University of Michigan; *Gove Hambidge*, special assistant to the director, Food and Agriculture Organization of the United Nations; *Knowles A. Ryerson*, dean of the College of Agriculture, University of California; and *Frans Verdoorn*, editor, *Chronica Botanica*.

8. Nuclear Engineering

Tuesday evening, December 27, Parlor 1, Hotel Statler, at 7:30 p.m. Arranged jointly by *Frank D. Carvin*, Department of Mechanical Engineering, Illinois Institute of Technology, and Secretary of AAAS Section M—Engineering, and *Irving P. Orens*, chairman of the Graduate Division, Newark College of Engineering; a joint program of Section M and the Newark College of Engineering. *Irving P. Orens*, presiding. *Robert W. Van Houten*, president of the Newark College of Engineering, will deliver an address of welcome. Speakers: *W. R. Woolrich*, dean of engineering, University of Texas and Chairman of AAAS Section M; *K. D. Nichols*, Major-General, U. S. Army; *Conrad P. Straub*, U. S. Health Service, Oak Ridge, Tennessee; and *Irving P. Orens*, chairman, Graduate Division, Newark College of Engineering.

9. Television

Arranged jointly by *Frank D. Carvin*, Department of Mechanical Engineering, Illinois Institute of Technology and Secretary of AAAS Section M—Engineering, and *I. E. Lattimer*, American Telephone and Telegraph Company; a joint program of Section M and the New York Section of Electrical Engineers. Two sessions.

1. Technology of Television. Wednesday evening, December 29, Crystal Room of the Hotel McAlpin, at 8:00 p.m.; Round Table Discussion. *John V. L. Hogan*, president, Hogan Laboratories, Inc., moderator. Speakers: *John H. Roe*, supervisor, Television Engineering Group, Radio Corporation of America; *R. M. Bowie*, manager, Physics Laboratories, Sylvania Electric Products Company; and *T. T. Goldsmith, Jr.*, director of research, Allan B. DuMont Laboratories.

2. Impact of Television on Society and Future Developments. Thursday evening, December 29, Crystal Room of the Hotel McAlpin, at 8:00 p.m.; Round Table Discussion. *W. L. Laurence*, science reporter, The New York Times, moderator. Speakers: *Sterling Fisher*, manager of public affairs and education; National Broadcasting Company; *Ricardo Muniz*, general manager, Allan B. DuMont Laboratories; and *Finley Carter*, vice president in charge of engineering, Sylvania Electric Company.

10. The Adrenal Cortex

Arranged by *Gordon K. Moe*, Department of Pharmacology, University of Michigan and Secretary of AAAS Section N—Medical Sciences and Subsection Nm—Medicine. Four sessions.

1. Wednesday morning, December 28, Keystone Room, Hotel Statler, at 9:30 a.m.; *J. S. L. Browne*, McGill University, presiding. Speakers: *C. H. Li*, University of California; *C. N. H. Long*, Yale University; *J. W. Conn*, University of Michigan; *Floyd R. Skelton*, University of Montreal; *Dwight J. Ingle*, The Upjohn Company; and *G. W. Wooley*, Roscoe B. Jackson Memorial Laboratory.

2. Thursday morning, December 29, Keystone Room, Hotel Statler at 9:30 a.m.; *D. J. Ingle*, The Upjohn Company, presiding. Speakers: *Abraham White*, University of California; *Frank L. Engel*, Duke University; *Thomas F. Dougherty*, University of Utah; *Burton L. Baker*, University of Michigan; *Roy O. Greep*, Harvard University; *Helen W. Deane*, Harvard University; and *Robert Gaunt*, Syracuse University.

3. Thursday afternoon, December 29, Keystone Room, Hotel Statler, at 2:00 p.m.; *C. N. H. Long*, Yale University, presiding. Speakers: *Alan Gregg*, Rockefeller Foundation; *Frederic C. Bartter*, Massachusetts General Hospital; *J. S. L. Browne*, McGill University; *Laurence*

W. Kinsell, University of California; *O. H. Pearson,* Sloan-Kettering Institute; and *L. P. Eliel,* Sloan-Kettering Institute.

4. Thursday evening, December 30, Keystone Room, Hotel Statler, at 7:30 p.m.; *J. R. Mote,* Armour Laboratories, presiding. Speakers: *E. Venning,* McGill University; *Konrad Dobriner,* Sloan-Kettering Institute; *H. L. Mason,* Mayo Clinic; *R. G. Sprague,* Mayo Foundation; *M. H. Power,* Mayo Foundation; *A. C. Corcoran,* Cleveland Clinic Foundation; *E. S. Gordon,* University of Wisconsin; and *Hudson Hoagland,* Worcester Foundation for Experimental Biology.

NEWS and Notes

Louis W. Hutchins, member of the staff of the Woods Hole Oceanographic Institution, has been appointed director of the Bermuda Biological Station. Dr. Hutchins will still devote part of his time to Woods Hole, where his chief work has been directing Navy-financed studies on organisms causing fouling on marine vessels and structures.

Karl T. Compton has resigned as Chairman of the Research and Development Board of the National Military Establishment because of ill health. Pending the naming of a successor, President Truman announced that the board would be headed, at Dr. Compton's suggestion, by Robert F. Rinehart as deputy chairman.

Alfred H. Hausrath, Jr. has been appointed director of the Cooperative Test Division of Educational Testing Service, Princeton, New Jersey. He was formerly consultant on training and personnel administration for the Foreign Military Assistance Program of the Department of State.

Roscoe F. Sanford has retired after more than 30 years of service as spectroscopist in Pasadena, at the Mt. Wilson and Palomar observatories. Before going to Mt. Wilson, Dr. Sanford had been stationed at observatories in Argentina for three years by the Carnegie Institution and in Chile for four years by Lick Observatory. At Mt. Wilson he pioneered the application of high dispersion to variable and double stars and made notable photographs of the spectra of cool red "carbon" stars.

Granville A. Bennett, professor of pathology and chairman of the department, University of Illinois College of Medicine, will deliver the fourth Richard H. Jaffé Memorial Lecture of the Institute of Medicine of Chicago on Friday evening, November 25. His subject will be "Reactive and Neoplastic Changes in Synovial Tissues."

John E. Barkley, supervisor of physical chemistry research at Armour Research Foundation of Illinois Institute of Technology, is spending two weeks in London, consulting with British scientists on the latest developments in infrared photocell research. Dr. Barkley has visited several laboratories in England and participated in field tests. He expects to return to the U. S. about November 18.

John M. Brookhart has recently resigned his position as assistant professor of physiology at Northwestern University Medical School to take up duties as associate professor of physiology at the University of Oregon Medical School, Portland, Oregon.

Marshall J. Walker, formerly of the Alleghany Ballistics Laboratory and the National Bureau of Standards, and **Stephen S. Friedland,** University of New Mexico physicist, have joined the staff of the Physics Department of the University of Connecticut. Dr. Friedland is planning to build a mass spectrometer especially adapted for the analysis of biological materials.

Oskar Baudisch, director of research at Saratoga Springs Commission, is spending the winter as a visiting investigator at the Scripps Institution of Oceanography, La Jolla, California. Dr. Baudisch is engaged in the organization of a research program on trace elements in the sea and marine organisms.

Visitors to U. S.

F. C. Bawden, head of the Plant Pathology Department, Rothamsted Experimental Station, England, and author of the standard treatise, *Plant viruses and virus diseases,* will be a visiting lecturer at Yale University during March, 1950. Mr. Bawden will deliver a series of ten lectures on plant viruses under the auspices of the Yale Departments of Plant Science and of Microbiology. Following his residence at Yale, Mr. Bawden will visit laboratories and experiment stations throughout the country. Further information on these lectures may be obtained from Prof. Henry P. Treffers, Director of Graduate Studies in Microbiology, Yale University.

Luis Molina Johnson, director of the training station in tropical diseases in Boca del Rio, Vera Cruz, spent a week in Washington, D. C. consulting with the World Health Organzation. Now in Ecuador, he will act as WHO consultant on maternal and child health.

Visitors at the National Bureau of Standards during the week of October 31–November 4 included: **Augusto Falcon de Gyves,** engineer with the Geophysics Institute of the University of Mexico; **G. G. Graham,** chief, technical services, National Film Board of Canada; **Ricardo Monges Lopez,** director, Geophysics Institute of the University of Mexico; **T. Mylvaganam,** irrigation engineer, Irrigation Laboratory, Department of Irrigation, Colombo, Ceylon; **R. A. Smith,** superintendent of Physics Department, Telecommunications Research Establishment, Gt. Malvern, England; **Alfonso Vaca Alatone,** engineer with the Geophysics Institute of the Uni-

versity of Mexico; and **Rafael J. Larnarca, Albino del Rosario,** and **Calixto S. Rozal,** members of the Philippine Coast and Geodetic Survey, Manila, Philippine Islands.

Grants and Awards

Irving Langmuir, associate director of the General Electric Research Laboratory, recently became the second American scientist to receive the **Mascart Medal,** awarded triennially by the Société Francaise des Electriciens to a scholar or engineer "who is distinguished by an ensemble of works on pure or applied electricity." The American Institute of Electrical Engineers made the presentation of the award, for the year 1948, in behalf of the French organization.

The Gordon McKay Endowment, established in 1909 "to promote applied science" at Harvard University, granted $8,626,506 to the university this month, bringing to a total of $15,766,755 the amount Harvard has received from this source. The Faculty of Arts and Sciences will receive $2,000,000 of the latest grant, with the remainder to be allocated following a review of the entire Harvard program in applied science and engineering.

The Roebling Medal was awarded for distinguished achievement in the field of mineralogy to Herbert E. Merwin, Geophysical Laboratory, Washington, D. C., at the thirtieth annual meeting of the Mineralogical Society of America in El Paso, Texas, November 10–12.

The first John H. Potts Memorial Award was given to Harry F. Olson, director of the RCA Acoustical Research Laboratory at Princeton, New Jersey, by the Audio Engineering Society on October 28. The medal was given to Dr. Olson "for outstanding accomplishments in the field of audio engineering." He is the author of *Elements of acoustical engineering* and *Dynamical analogies.*

The 1949 Sedgwick Memorial Medal has been granted by the American Public Health Association to Henry F. Vaughan, dean of the School of Public Health, University of Michigan. Dr. Vaughan was active in the organization of the National Sanitation Foundation.

The Sharp and Dohme Award of the American Physiological Society has been granted to Wallace O. Fenn, professor of physiology at the University of Rochester. In addition to a stipend, the award entitles Dr. Fenn to represent the society at the 18th International Physiological Congress in Copenhagen, in August, 1950.

The Ipatieff Prize in Chemistry for 1950 has been awarded to Herman E. Ries, Jr., research chemist at the Sinclair Refining Company Research Laboratories, Harvey, Illinois. The $3,000 award is given every three years to a scientist under 40 for achievement in the study of catalysis or high pressure.

Fellowships

General Electric Company is accepting applications for the year 1950–51 for its **Charles A. Coffin Fellowships** in electricity, physics, and physical chemistry, and its **Gerard Swope Fellowships** in engineering, industrial management, and the physical sciences. The fellowships, made from the corporation's Educational Fund, include a stipend up to $1,500, and, if necessary, an additional grant of $500 for special equipment. Loans up to $1,000 may also be granted. Applications must be filed before *January 1, 1950,* and are available through technical schools and universities or from A. D. Marshall, Secretary, General Electric Educational Fund, Schenectady, New York.

The National Research Council has announced the availability of **RCA Predoctoral Fellowships in Electronics** for 1950. These fellowships, supported by the Radio Corporation of America, are designed to give special graduate training and experience in research to young men and women who have demonstrated marked ability in electronics, either as a branch of electrical or radio engineering, or in that field of physics which treats the behavior of electrons in conductance phenomena.

Applicants should have training in electronics equivalent to that represented by one year beyond the bachelor's degree, in a university of recognized merit in this field, and must be citizens of the U. S.

Fellowships will be awarded at a regular meeting of the RCA Fellowship Board in March, 1950. Applications must be filed on or before *January 10, 1950.* Unless otherwise arranged, tenure will begin in September, 1950.

National Research Fellowships in the Natural Sciences will be continued in 1950. These fellowships, which are being offered for the 31st consecutive year, are supported by the Rockefeller Foundation to promote fundamental research in the natural sciences. Fellowships are available in the fields of mathematics, astronomy, physics, chemistry, geology, geophysics, paleontology, physical geography, botany, zoology, biochemistry, biophysics, agriculture, forestry, anthropology, and psychology.

These fellowships are awarded to citizens of the U. S. or of Canada, and generally only to persons under 35 years of age. The requirements for the doctorate must have been completed prior to assuming the fellowship, and the fellow must have demonstrated a high order of ability in research.

Fellowships will be awarded by the Natural Sciences Fellowship Board at its meeting in March, 1950. Applications to be considered at this meeting should be filed on or before *January 1, 1950.* Tenure of the fellowship may begin at any appropriate time after the board meeting.

Further information concerning these fellowship programs may be obtained from the Fellowship Office, National Research Council, 2101 Constitution Avenue, N.W., Washington 25, D. C.

Colleges and Universities

California Institute of Technology's new hypersonic wind tunnel permits tests at a speed of more than ten times the velocity of sound. A guided missile designed with the aid of the new tunnel could travel a distance of 7,600 miles in about an hour, well above the top rocket speed

far reported. The Mach 10 tunnel, operated under Army Ordnance Department contract, will be used to obtain basic information about the design, performance, and instrumentation of tunnels for hypersonic speeds.

Ohio State University's new Institute for Research in Vision will have as codirectors Glenn A. Fry, director of the School of Optometry, and Arthur M. Culler, chairman of the Department of Ophthalmology. The new research center will coordinate research in other fields besides optometry and ophthalmology. Among these will be physics, psychology, physiology, pediatrics, bacteriology, anatomy, veterinary medicine, and zoology.

A children's neurological ward has been opened at the Illinois Neuropsychiatric Institute, Chicago. The medical staff for the ward will be provided by the **College of Medicine of the University of Illinois.** Eric Oldberg, professor of neurology and neurological surgery and head of the department, has been appointed supervisor.

The University of Maine dedicated two new buildings last week. The Engineering Building will house the Civil and Mechanical Engineering Departments, a highway testing laboratory, and geology classrooms. The Plant Science Building will be headquarters for the Departments of Botany and Entomology, Agronomy, Horticulture and Forestry, and will also provide space for the Agricultural Experiment Station laboratories and the Maine Extension Service.

Industrial Laboratories

Bryan C. Redmon has been appointed assistant director of organic chemical research by **U. S. Industrial Chemicals, Inc.,** at the company's Baltimore laboratories. Dr. Redmon was formerly with American Cyanamid Company and on the faculty of the University of Massachusetts.

The U. S. Atomic Energy Commission has approved the export of a two-Mev electrostatic x-ray generator, for use in the treatment of cancer, to the Westminster Hospital, St. Johns Gardens, London. The fourth to be approved for export to England for radiation therapeutic uses during the past two years, the generator will be manufactured by the **High Voltage Engineering Corporation,** Cambridge, Massachusetts.

The Sahyun Laboratories for research in medicinal chemistry, nutrition, biochemistry, and pharmaceutical products were opened recently at Santa Barbara, California, by Melville Sahyun, formerly vice president and director of research of the Frederick Stearns and Company Division of Sterling Drug, Inc.

Meetings and Elections

The fifth annual conference of the Georgia Section of the American Chemical Society will be held at the Georgia Institute of Technology, Atlanta on November 18. Twenty-nine papers will be presented by scientists from Emory University, Georgia Institute of Technology, Wesleyan College, the Georgia Experiment Station, and the University of Georgia.

A series of meetings devoted to the fundamental problems of growth and malignancy will be presented throughout the winter by the Department of Pathology of the College of Medicine at the University of Vermont. All meetings will be at 8 p.m. in the university's Fleming Museum in Burlington. Charles B. Huggins, professor of surgery, University of Chicago, will be the speaker at the first meeting on December 2 with a lecture on "Serum Proteins in Cancer."

Other speakers scheduled are Leonell C. Strong, professor of anatomy at Yale School of Medicine, to speak January 5 on "Genetics and Cancer"; Albert J. Tannenbaum, February 9, "Diet and Cancer"; Van R. Potter, professor of oncology, University of Wisconsin Medical School, March 2, "Enzymes, Growth, and Cancer"; Roy Hertz, chief of the Endocrinology Section of the National Cancer Institute, March 30, "Vitamin-Hormone Interrelationships Affecting Tissue Growth"; and Robert E. Stowell, professor of oncology, University of Kansas School of Medicine, May 4, "Nucleoproteins, Growth, and Cancer."

The Association of Urban Universities, at its 35th annual meeting in Chicago on October 31, elected as president James Creese, president of the Drexel Institute of Technology, and as vice president David A. Lockmiller, president of the University of Chattanooga, and reelected David D. Henry, president of Wayne University, as secretary-treasurer.

The National Tuberculosis Association will hold its 46th annual meeting April 24–28, 1950, at the Hotel Statler, Washington, D. C. Meeting concurrently with the NTA will be its Medical Section, the American Trudeau Society, and the National Conference of Tuberculosis Secretaries. The medical sessions will be devoted to the chemotherapy of tuberculosis, surgical aspects of tuberculosis, laboratory investigations, and nontuberculous diseases of the chest. Further information may be obtained by writing the National Tuberculosis Association, 1790 Broadway, New York City 19.

The Biennial Congress of the International Society of Hematology will be held August 21–26, 1950, at the University of Cambridge in England. The Program Committee is considering titles for papers and exhibits to be presented. Material should be submitted as soon as possible to I. Davidsohn, Mt. Sinai Hospital, Chicago, or S. Mettier, University of California, San Francisco.

The Engineering Foundation elected the following officers at the annual meeting of its board: Boris A. Bakhmeteff, consulting engineer and professor of civil engineering, Columbia University, chairman; and C. G. Suits, of General Electric Company, vice chairman. Frank T. Sisco was reelected technical director, and John H. R. Arms, secretary.

Dr. Bakhmeteff was also appointed chairman of the Executive Committee, whose other members are John H. R. Arms, C. G. Suits, A. B. Kinzel, vice president of the Union Carbide and Carbon Research Laboratories, Inc., Herman Weisberg, me-

chanical engineer in the Electrical Engineering Department of the Public Service Company of New Jersey, and D. A. Quarles, vice president of the Bell Telephone Laboratories, Inc.

The Research Procedure Committee also will be headed by Dr. Bakhmeteff. Other members are E. R. Kaiser, assistant director of research, Bituminous Coal Research, Inc., Herman Weisberg, and C. G. Suits.

Deaths

Gebhard Stegeman, 59, professor of chemistry at the University of Pittsburgh, and a member of the staff since 1919, died of a heart attack September 5 at his home in Pittsburgh. Dr. Stegeman's most recent research was on the specific heat of sugar.

Earl O. Wilson, 59, professor of industrial and engineering chemistry at Yenching University, Peiping, for 21 years, died September 30 at Covina, California. During the war, Dr. Wilson was interned by the Japanese at Weihsien in Shantung and was later repatriated. He retired in 1944 because of ill health.

Sterling Henry Diggs, chemist, died at his home in Charlottesville, Virginia, on September 5, at the age of 70. Dr. Diggs was director of research for the Standard Oil Company of Indiana at Casper, Wyoming, from 1923 until his retirement in 1940.

Royall O. Davis, 69, administrative assistant in the Soils Division of the Agriculture Department's Bureau of Plant Industry died October 30 of a heart attack. During World War II, Dr. Davis conducted research for the U. S. Army on the fire and explosion hazards of ammonium nitrate.

The National Registry of Rare Chemicals, 35 West 33rd Street, Chicago 16, Illinois, has submitted the following list of wanted chemicals: berbamine; isatin chloride; jervine; 1,3 - bis - (3 - methyl - 4 - nitro - 5 - pyrazolyl)-1,2,4-triazole; zinc carbide; 1,8-diiodooctane; 1,9-diiodononane; 4-bromocyclohexanone; 4-methyl - 4 - bromocyclohexanone; 5 - aminocaproic acid; 7-aminocaprylic acid; 4,6-diaminoquinaldine; difluorochloroacetic acid; *p*-aminohexahydrobenzoic acid; 4-hydroxymethylimidazole; pyridine-3,5-dicarboxylic acid; 2,5 - dimercaptothiodiazole; sphaerophorin; atraric acid; and L-α-glycerylphosphorylcholine.

Edward Pyddoke, curator of the Sussex Archaeological Society in England, informs *Science* that he is searching for archaeological and paleontological material excavated from Kent's Cavern, Torquay, Devonshire, during the 19th century. There is no complete catalogue and he believes much of the material has found its way into museums and private collections. Dr. Pyddoke is compiling an illustrated monograph at the request of the British Association for the Advancement of Science. Communications should be sent to him in care of the Sussex Archaeological Society, Barbican House, Lewes, England.

The Mathematics Department of **Harvard University** expects to have one or two vacancies in the rank of Benjamin Peirce Instructor beginning in the fall of 1950. Appointments are for a maximum period of three years. Applications should reach the department prior to *March 15, 1950.*

Units of Radioactivity. In November, 1947, a joint committee of the Divisions of Chemistry and Chemical Technology and of Mathematical and Physical Sciences of the National Research Council was appointed to make recommendations regarding standards and units of radioactivity. This committee unanimously adopted the recommendations quoted below. The committee would like to point out that these recommendations effectively divorce the curie from the disintegration rate of radium by assigning to the former an arbitrary magnitude (3.7×10^{10} dis/sec) approximately equal to the disintegration rate of radium. This arbitrary figure is therefore not influenced by any future revisions of the generally accepted disintegration rate of radium. This recommendation has been submitted to the Joint Commission on Standards, Units, and Constants of Radioactivity of the International Unions of Chemistry and Physics for the purpose of obtaining international agreement.

This changes, slightly, the meaning of the curie when applied to radium. For example, 1 curie of radon is no longer, on the basis of these recommendations, the amount in equilibrium with 1 gram of radium, but is the amount undergoing 3.7×10^{10} disintegrations per second. Similarly, 1 mg and 1 mc of radium are no longer rigorously synonymous. This distinction has a number of precedents in physics; for example, the international ampere, now abolished, was not quite equal to the absolute ampere and the angstrom unit is nearly, but not quite, equal to 1000 x-units.

"curie The curie should be defined as that quantity of any radioactive species (radioisotope) undergoing exactly 3.700×10^{10} disintegrations per second.''

"rutherford The rutherford should be defined as that quantity of any radioactive species (radioisotope) undergoing 10^6 disintegrations per second.''

"rhm For the quantitative comparison of radioactive sources emitting gamma rays, for which disintegration rates cannot be determined, the *roentgen per hour at one meter* (rhm) is recommended. This is not essentially a new unit, since all units involved are well established, explicitly defined, and are in common usage.''

The recommendation of this latter unit is a practical step to insure that, by its use, gamma ray measurements are so made with instruments and under such conditions that measurements on a given isotope (nuclear species) made in any laboratory will be directly comparable with similar measurements made in other laboratories. This will result if the procedures used comply with the definition of the unit; that is, a source is 1 rhm if it produces 1 roentgen per hour at a distance of 1 meter.

L. F. CURTISS, *Chairman,*
R. D. EVANS, WARREN JOHNSON,
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